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Electrical World

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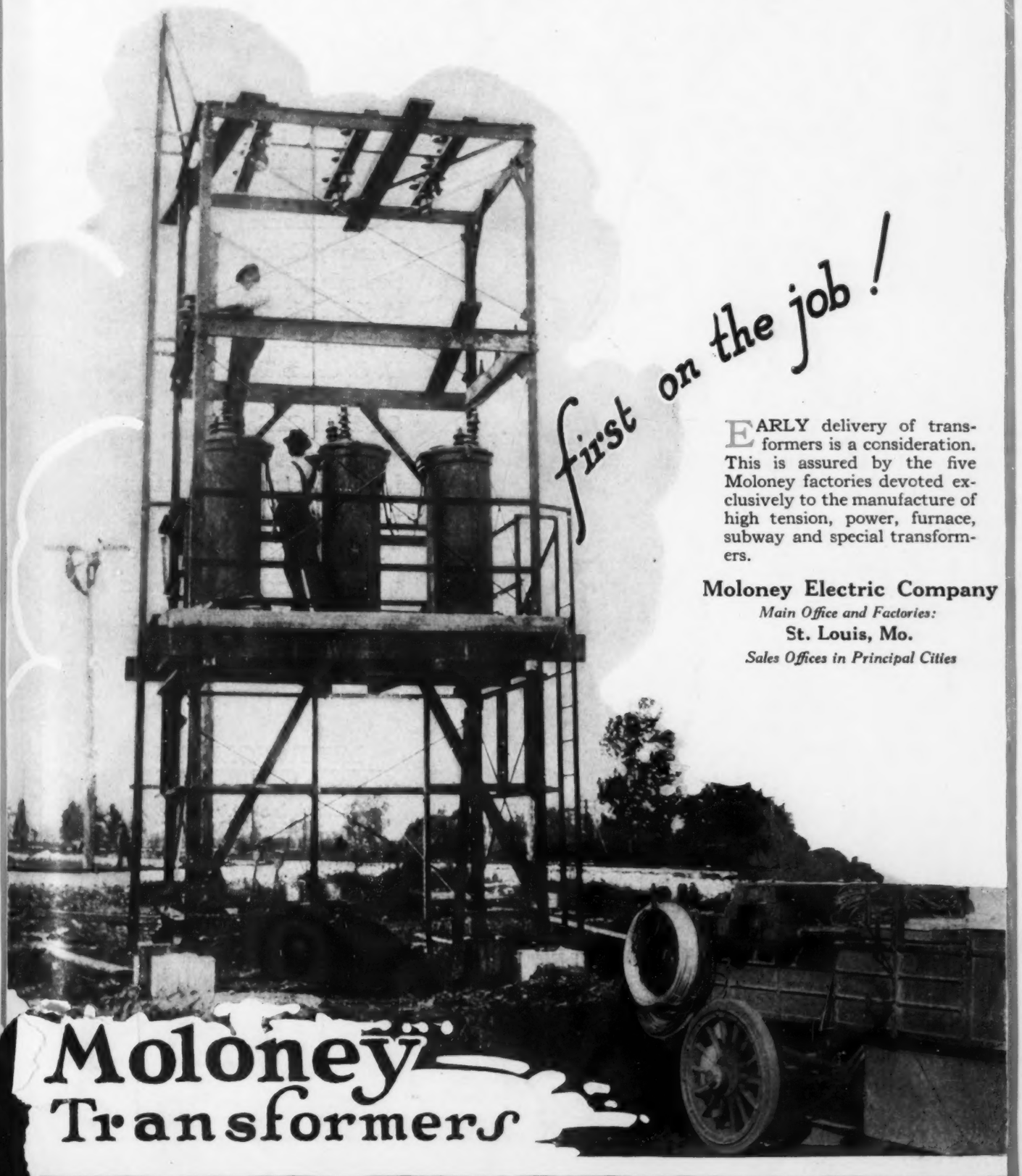

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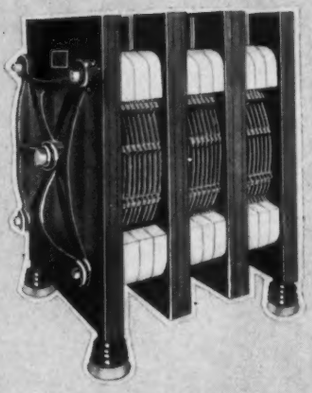

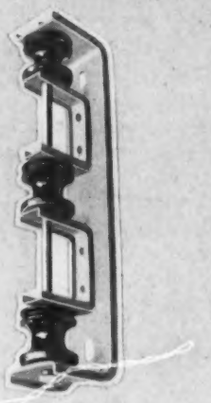

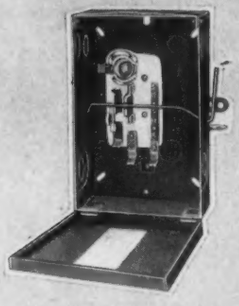

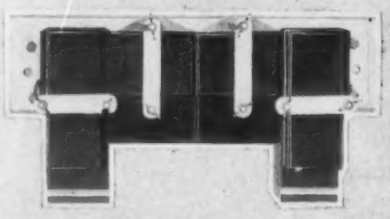

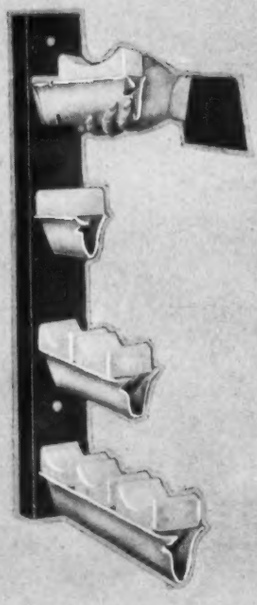

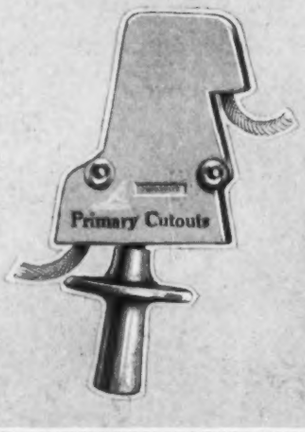

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Electrical World

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The Pendulum and the Balance Wheel

IN HUMAN affairs the swinging pendulum has an age-long tendency to erratic motion from which utility company affairs have not always been exempt. The way in which the pendulum of central-station interest has been allowed to swing from one activity to another in past years, as evidenced by convention programs, makes clear the advisability of maintaining a more even balance. In the past seesawing between engineering construction and market building has been the rule. Interest has now concentrated in one direction, and it embraces not only commercial development but public relations and financing. No one can dispute the importance of these subjects. Without them engineering development is of little use, and too possibly engineers have had to be pulled out of their technical environment to gaze upon the realities without which their occupation would be gone.

None the less, is there not danger, if technical discussions be suppressed too much in favor of the subjects of the hour, that engineers, deprived of extensive opportunities for exchange of experience, will find themselves five years hence behind commercial demands? The answer seems simple. The interest of engineers in the broader phases of electrical development having been aroused, keep it active by arranging convention programs and company conferences where discussions on commercial development, public relations and financing can be heard jointly by engineers and their colleagues in other lines of electrical endeavor. Following a joint session of this nature, the commercial, public relations, financing and engineering phases of the industry can be discussed separately and in detail. The enlightening influence of the preliminary general discussions will keep each branch of the business awake to its relations to the whole and will serve as a coordinating force without producing such extreme swings of the pendulum as have been experienced in the past.

Waste in Buying and Selling

THE development of an intensive and specialized sales service in a highly competitive and unstandardized industry may introduce waste as well as increase service efficiency. Buyers and sellers realize that sales costs are not always productive or even essential. For example, a customer solicits bids and design drawings on a contract that may involve about five thousand dollars. Immediately several bidders make elaborate engineering drawings, send engineers and salesmen to inspect the job, interview the buyer and go to other expense that may aggregate a total of four thousand dollars in sales cost. In job after job this cost element may be introduced and duplicated and thus come into distribution costs as a waste.

This waste is no fault of the buyer or the seller, but is incidental to competition and intelligent sales service. In a sense these costs are not wastes, but represent the cost of legitimate service to the buyer. No one would desire to return to non-service sales or to older ideas of manufacturers' service. But each buyer and each seller can do much to keep these sales costs to a minimum. The buyer can design his job in detail and make his specifications complete in order to reduce the necessity of several sellers doing this work for him. In addition, if the buyer has fixed his mind on a seller and merely seeks many bids to use as price levers, he is not making for economy in sales nor is he dealing fairly with the bidders. His temporary price advantage will necessarily in the long run come home to him. The seller also can watch his sales service costs and make sure they result in a maximum amount of productive return. While it is undesirable to restrict wise competition and to reduce the quality of sales service, there is no question that the industry can study the situation and make worth-while reductions in waste.

Practical Aspects of Stability in Transmission Lines

THE question of stability in transmission lines is becoming of greater and greater importance as the economical loading limit approaches the point at which the line becomes unstable. On the lower voltages and shorter lines used in the past the economical loading point has been so far below the theoretical limit that the question of stability has not been of such importance.

The subject has received academic and experimental study as evidenced by recent technical papers. Some field tests have already been made on one of the large systems of California, and further tests are to be made soon when additional facilities are available. The tests thus far made indicate that one of the most important phases of the problem is what will happen when the load is suddenly dropped from one of two lines operating in parallel. A factor enters here which at first thought is not evident. The flywheel effect of the generating plant may cause a load in the remaining line greater than it will stand without exceeding the stability limit.

For example, when one of the Big Creek 220-kv. lines was recently out of service for inspection the load on the remaining line crept up gradually during the late afternoon and, at a point which was later determined to be 183,000 kw., became unstable and the synchronous apparatus at the two ends of the line went out of step. This is quite a different thing from having two lines operating in parallel and having one of them "relay out" because of trouble and suddenly impose a heavy load on the second line. That is to say, it would not be safe to operate these two lines in parallel, each carrying half of 183,000 kw., if it were possible for one entire line to relay out. The flywheel effect of the generating plant would cause the second line to become unstable owing to overswing. Of course, in actual practice only a comparatively short section of one line will relay out in case of flashover or other trouble, and the prac-

tical operating limit of stability depends upon the longest section of line which can be relayed out without causing the remaining lines in service to become unstable.

There has been comparatively little operating experience which can be considered as applying to the solution of the problem, and it would be desirable if any experience hereafter encountered could be gathered together in the interest of solving some of the problems of high-voltage long-distance transmission.

Status of the Uniform Ordinance

UNIFORMITY in legislation makes for the common good. Uniformity in electrical practice makes for the pocketbook. It cut lines; it standardizes manufacturing processes; it cuts manufacturing costs; it reduces the price the consumer pays, which is the goal of sales effort. One element of manufacturing cost is inspection and test of various kinds, in the laboratory, in the factory and by municipal inspectors. Every reason demands, therefore, that municipal tests and inspection should be governed by the same standards, for otherwise manufacturers must build to suit hundreds of minds each with a particular fancy. Uniformity in municipal electrical codes would be impracticable, however. Improvements come, the art changes, refinements are made, but municipal legislative bodies move slowly to improve and sometimes not at all. Nevertheless, some device is necessary to embody in municipal practice, inspections and tests the latest and best in electrical practice.

The National Electrical Code has been in process of evolution for many years. The 1923 edition is a standard of the American Engineering Standards Committee; the 1925 edition will likewise become an A. E. S. C. standard. The National Electrical Safety Code is also a product of the best electrical knowledge and experience and is an A. E. S. C. standard. These codes should be national in application as well as in name; they should by their merit be the standards applied all over the United States. But in most states, if not all, a municipal legislative body cannot by ordinance provide that the provisions of the National Electrical Code or the National Electrical Safety Code, as amended from time to time, shall be binding in that municipality. So to do would delegate legislative authority, which is not permissible. Private codes cannot be incorporated into law by reference. The city lawmakers may adopt an ordinance which contains the electrical code and the safety code word for word, but whenever the code changes, the ordinance must be amended, and that is slow, laborious, and, more often than not, will not be done.

In the uniform ordinance prepared by the Electrical Manufacturers' Council, the third edition of which is just off the press, these legal and practical situations are realized, and it is provided that electric installations must conform to "the most approved methods of construction for safety to life and property." That is the aim of the ordinance as it is of the industry. These methods of construction, however, must be tested by some standard. The uniform ordinance, therefore, provides in Section 7 that the regulations as laid down in the National Electrical Code, as approved by the American Engineering Standards Committee, and in the National Electrical Safety Code, as approved by the American Engineering Standards Committee, and other installation and safety regulations approved by the American Engineering Standards Committee shall be *prima facie* evidence of such most approved methods.

Thus the National Electrical Code, the National Electrical Safety Code and other installation and safety regulations approved by the American Engineering Standards Committee are, by the uniform ordinance, made the unofficial standards—the measures by which courts will test the action of the municipal inspector in issuing or refusing to issue his certificate of approval. The burden is not upon the manufacturer, jobber or contractor-dealer if the installation is in accordance with the A. E. S. C. regulations. Local requirements differing from these may be tested as to their reasonableness in court, and the imprimatur of the American Engineering Standards Committee will have a real effect upon the presiding justice because of its personnel.

The Association of Electragists International has cooperated with the Electrical Manufacturers' Council in the preparation of the new edition of this uniform ordinance. It has been approved by the Electrical Supply Jobbers' Association. Other national organizations in the industry will have the ordinance submitted to them so that it may have the full support of the industry. As there can be no question that the adoption of such an ordinance generally throughout the United States would be of inestimable value to the industry as a whole, it is to be hoped that all national electrical organizations will indorse the ordinance and take whatever steps they can to procure its adoption generally throughout the United States.

Government and Standardization

THAT the participation of government in business affairs should be minimized is the opinion both of the present administration at Washington and, needless to say, of leading business executives. But adherence to this policy does not mean that the government cannot aid industry in its constructive achievements through co-operation with company executives or that it should be deaf to the solicitation of industry for such assistance as it may properly and legally extend. Secretary Hoover has a clear realization of the place of government in business and has followed a definite policy in his constructive efforts in the direction of simplification and standardization in manufacturing and business.

Standardization should be brought about by industry —particularly standardization that requires technical research—and departures from this policy should be made only when industry feels that governmental cooperation would facilitate the work. In one or two instances the government has broadened its simplification activities in the direction of standardization, but only at the request of the industry concerned, and then only because a certain degree of standardization was necessary to insure simplification. Under the guidance of Secretary Hoover the government has taken the position of giving service to industry at the request of industry. It recognizes the right of industry to withdraw from any simplification or standardization program at any time and encourages the full development of industry initiative in simplification and standardization. No compulsion would be tolerated by industry, and responsibility properly rests upon those directly affected by the program.

Every opportunity for initiative on the part of standard-making organizations is afforded at this time, and

the effectiveness of their work can be increased in many cases by encouraging the co-operation of the government, especially since such co-operation places the wisdom, vision and personality of the present head of the Department of Commerce at the service of industry.

Agricultural Engineers for Power Companies

A RECOMMENDATION made by Owen D. Young in the Boston *Transcript* that power companies should establish agricultural departments to facilitate rural service brings into still sharper focus a current problem of wide interest to manufacturers, utilities and consumers. This problem is the prevailing question of how to provide electric service in farming areas without prohibitive cost, and solutions to it have been sought by the industry for many years. Mr. Young's suggestion seems entirely logical in view of the success thus far attained by central-station companies in developing industrial and residential business through the efforts of trained specialists in power and merchandising departments—men and women who can "talk the language" of manufacturer, merchant and homekeeper and thus prescribe more accurately and profitably for their respective needs in the way of equipment and service.

Without an intimate understanding of farming problems, the central-station engineer and manufacturer's representative run the risk of making grotesque and costly recommendations in regard to service and apparatus. The situation demands intelligent appreciation of the farmer's needs at least, and Mr. Young's advice to electric light and power companies is properly supplemented by several practical suggestions to farmers and manufacturers as the other parties to the problem. For it is plain that little can be done to overcome the economic handicaps of farm service without the co-operation of these three interests. Of the farmer it is required that he be open-minded, hungry to find new methods, take pride in the advancement of his business and show the initiative to promote it. The farmer should insist upon the study of electrification by his agricultural schools and colleges and require a constant and unending publicity for the results of such studies through the farm journals, co-operating with utility companies and manufacturers to work out practical plans to get effective results. In the past the farmer has been hampered by extreme individualism, but the door is now open for more effective co-operation.

The manufacturer must do his part in developing equipment adapted to farm needs and marketable at reasonable costs. The power companies can help the cause along by seeing to it that certain qualified employees make a serious study of rural service in all its phases, getting acquainted with farm customers, systematically investigating the economics of rural line extensions, obtaining information as to the performance of equipment in the field, and having a voice in the determination of rural rates, conditions of supply and financing arrangements. With such a personnel the power companies will be in a strong position to determine upon the justification for extending service into new territory and to develop the best possible public relations in such areas.

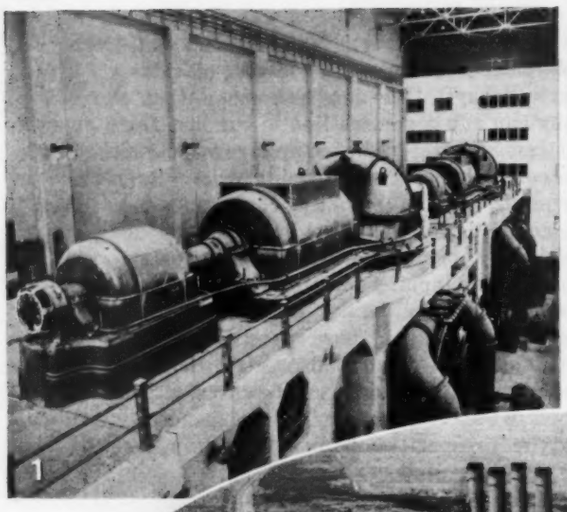
The extension of power-company operations into rural districts by the construction of lines and networks associated with interconnection and transmission puts a social as well as an economic responsibility upon the utility companies concerned and carries with it a certain obligation to serve district populations. As Mr. Young well says, this does not mean that the power company can run a service line to the last farm or even to the last village. The company must neither ride the economic hobby to the point where its service is not generally available in the community nor, on the other hand, ride the social hobby, as some loud-speaking and visionary persons outside the industry urge, to the point of financial bankruptcy. Just as the industrial service of the utility goes forward under the guidance of the skilled power engineer, so should the development of the farm load proceed under the trained hand and eye of this new type of central-station specialist, upon whose competency will depend in no small degree the prosperity of many communities and the success of their service.

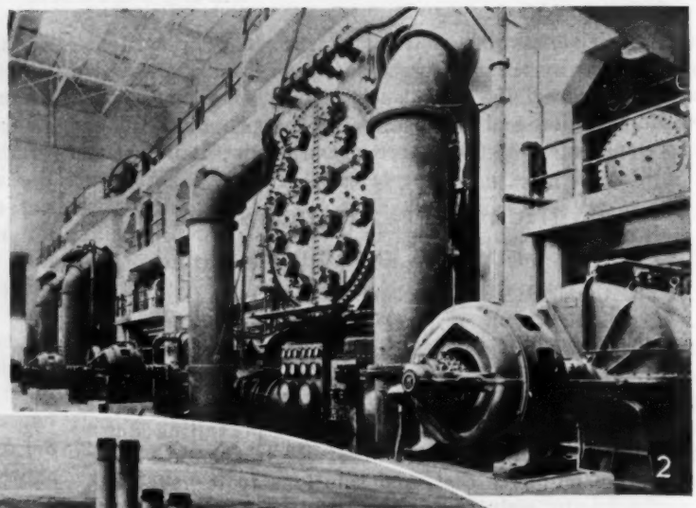
Most Economical Unit Loading Not Always Best Plant Loading

MANY operating companies which have taken enough interest in increasing plant economy to schedule the distribution of loads between turbines have based their schedule on the belief that the maximum plant economy will be obtained if the units with the lowest water rates are loaded up to the point of individual highest economy and the remaining load is placed on a unit or units having the next lowest water rate. This is an assumption which might appear obvious on first thought but is not true. The individual units may operate under such a schedule at maximum economy, but the composite economy will not be as high as possible for the station. The truth of this statement would become more apparent if some specific case were studied.

Once the fact is realized that the customary method of distributing plant loads among turbines will not give the highest plant economy, it usually becomes a question with most companies how to predetermine what the distribution of load should be for different plant units. Most cut-and-try methods have proved exceedingly laborious. On one system in the Middle West this objection has been answered satisfactorily by a graphical method which embodies mathematical precision. In general the plan involves the plotting of a set of curves with plant load as abscissas and rate of change of total steam with load as ordinates—first, with all machines in operation; second, with all machines in operation except that with the highest minimum water rate, and, third, with all machines in operation except the two having the highest minimum water rate, etc., until two or three machines are in operation. The point at which to cut out a particular unit is ascertained by drawing a horizontal line through these curves along the rate of change equal to the minimum water rate in pounds per kilowatt-hour of the first unit considered omitted.

With such facilities for analysis available, a company can schedule in advance how different plant loads can be distributed between units to avoid the decreased economy which comes from leaving this decision to the judgment of individual operators. Of course, latitude in applying the schedule of load distribution must be left to plant operators, because it is not practically feasible to cut out units at the exact load indicated. There must be enough reserve capacity in service to cover the loss of the largest machine in use. This necessitates taking off some machines at somewhat lower plant load than indicated.





Long Beach Plant Is Largest Steam Generating Station on Pacific Coast

THE new Long Beach plant No. 2 of the Southern California Edison Company contains two 35,000-kw. Curtiss turbo-generators, bringing the system generating capacity up to 465,000 kw. Of this 40 per cent is steam and 60 per cent is hydro.

The boilers are normally fired with natural gas from near-by oil fields, but provision has been made for burning fuel oil as well.

The plant was designed and built by Stone & Webster, Inc., in record time to meet the power shortage which was caused in southern California last year by a severe drought.

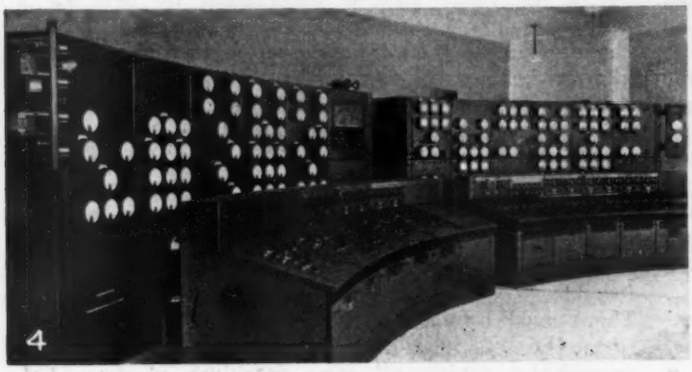
No. 1. Generator room, containing two 35,000-kw. turbo-generators

No. 2. Condensers and circulating water pumps, plant No. 2.

No. 3. Long Beach steam plants Nos. 1 and 2. Plant No. 2 is in the background.

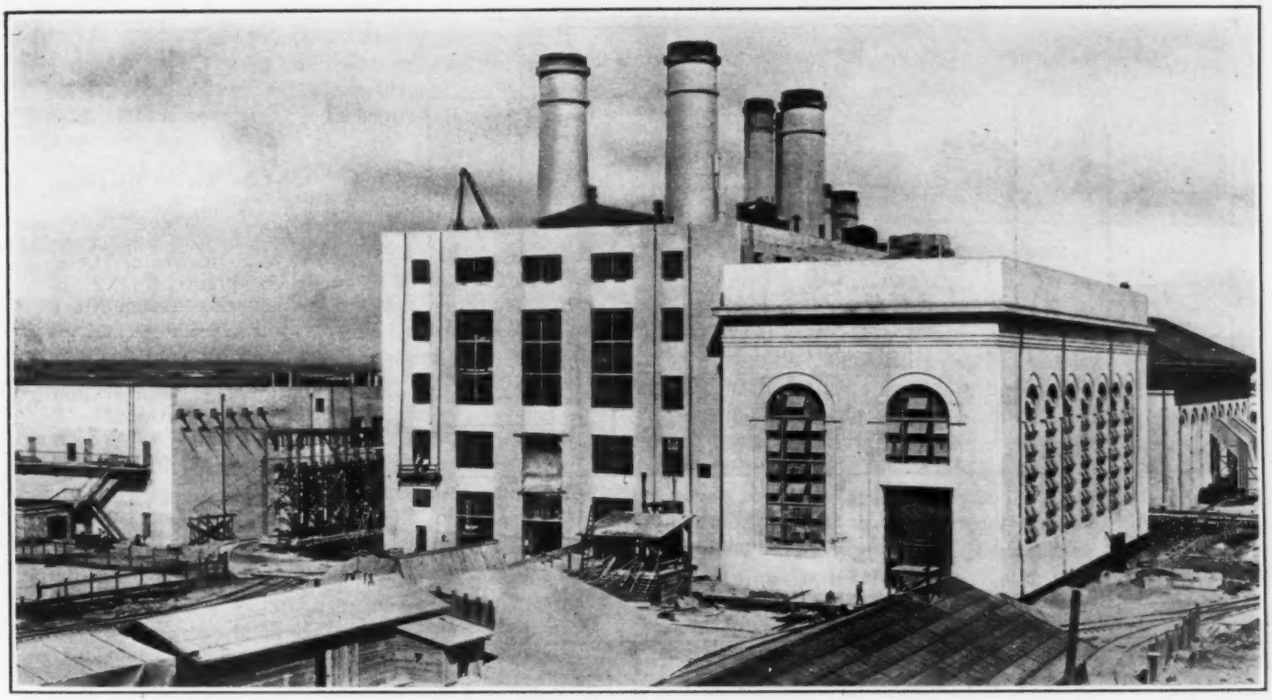
No. 4. Switchboard controlling both old and new Long Beach plants.

No. 5. Boiler room firing aisle, plant No. 2.



Characteristics of New Long Beach Plant

Ground Area of 0.5 Sq.Ft. and Building Volume of 50 Cu.Ft. per Kilowatt—Fuel Supply Is Piped to Station and Boilers Are Equipped to Burn Either Oil or Gas—Electrical Design Flexible



THE NEW LONG BEACH STATION

LONG BEACH plant No. 2 of the Southern California Edison Company adds 70,000 kw. to the generating capacity of the system and is a notable example of central-station construction under pressure of a water shortage which severely taxed the existing facilities of the system and led to emergency measures for relief. Twenty hydro-electric stations in the Sierra Nevada and San Bernardino Mountains, supplemented by steam plants at Long Beach, Redondo and Santa Barbara, now serve the system, with a combined capacity of 465,000 kw. Long Beach plant No. 2 was designed and built by Stone & Webster, Inc., Boston, and operates the largest steam generating units (35,000 kw.), the highest steam pressure (375 lb.) and the highest steam temperature (700 deg. F.) west of the Rockies.

PRINCIPAL DIMENSIONS OF LONG BEACH PLANT

Location	Long Beach, Cal.
Character of service	Base load power and light
Capacity, present	70,000 kw.
Capacity, ultimate	70,000 kw.
Boiler house	196 x 109 ft.
Turbine room	207 ft. x 67 ft.
Switch house	207 ft. x 78 ft.
Width firing aisle	20 ft.
Distance condenser floor to turbine room floor	32 ft.
Distance turbine room floor to crane rail	36 ft.
Distance turbine room floor to roof truss	48 ft.
Distance boiler room basement to boiler room floor	21 ft. 6 in.
Distance boiler room floor to boiler drums	32 ft. 9¼ in.
Distance boiler room floor to fan floor	52 ft. 3½ in.
Distance boiler room floor to roof truss	67 ft. 3 in.

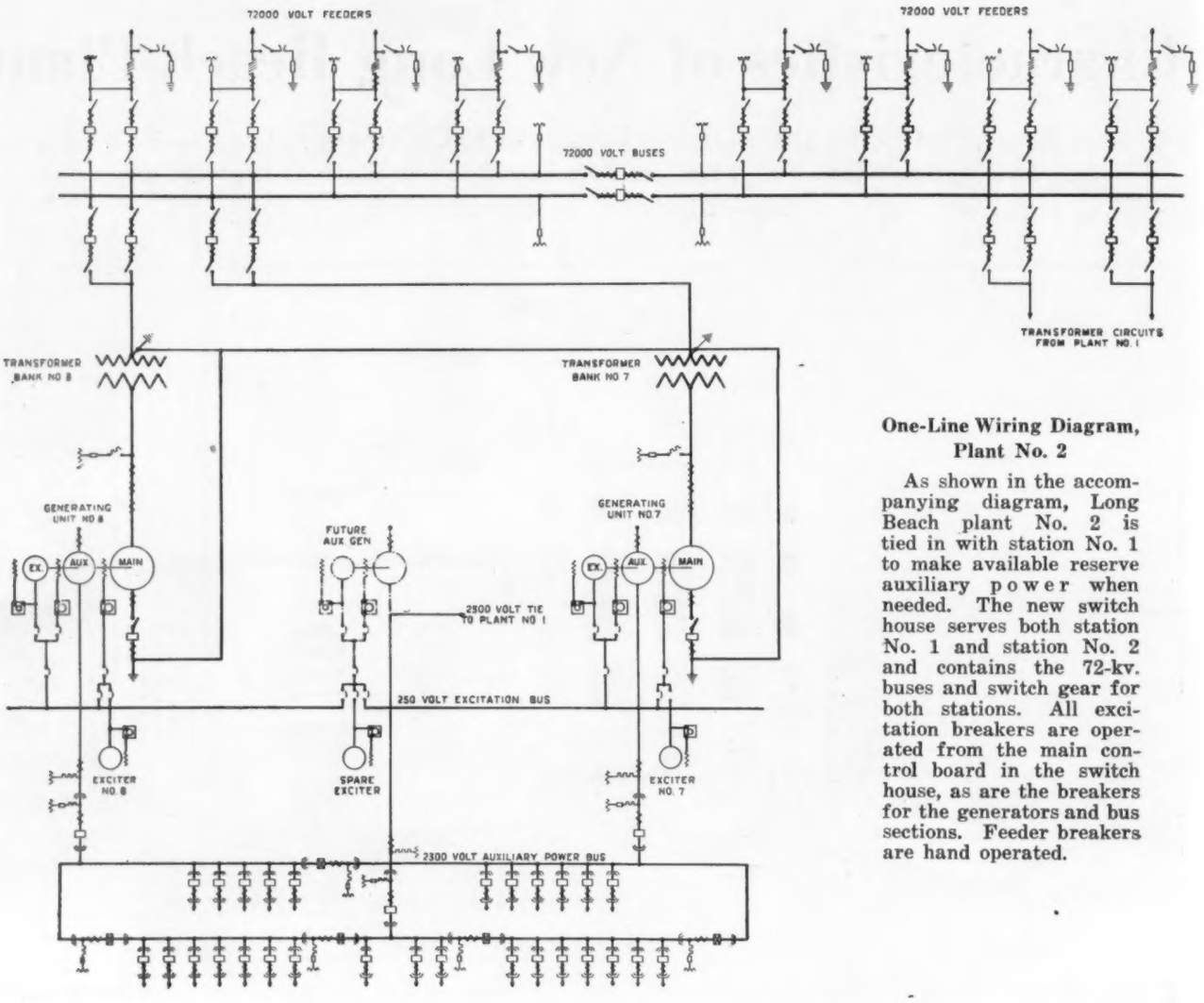
The site adjoins the well-known Long Beach station No. 1, and the development includes a new switch house from which both plants are operated. Fuel consists of natural gas or oil, as required, supplied through underground pipe lines. Condensing water is obtained from the adjacent Pacific, and the electrical output is delivered by 72-kv. overhead lines. The station is about 20 miles from Los Angeles.

The new plant contains eight boilers, each with fifteen burners having facilities for quick change-over from gas to oil. The furnace walls are ventilated to prolong the life of the brickwork. The admission of fuel into the furnace is automatically cut off in case of stoppage of an induced-draft fan.

TURBINE FEATURES

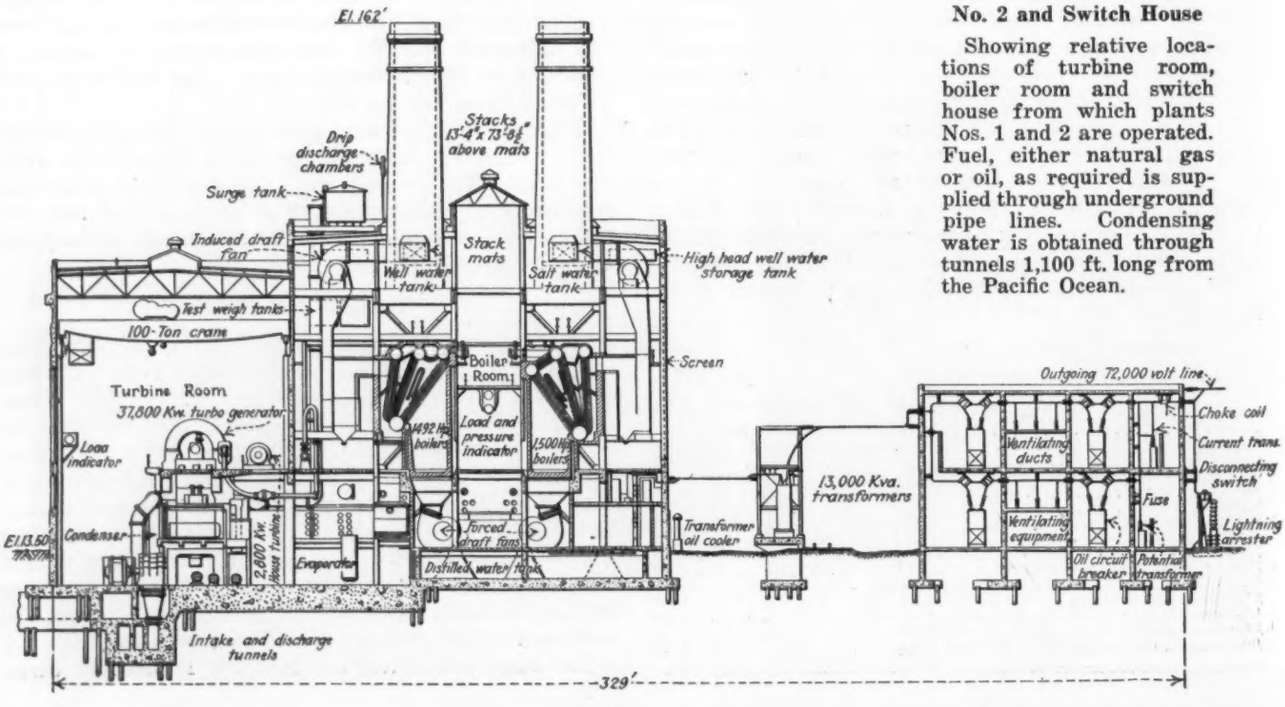
Each of the two main turbines drives a 38,889-kva., 90 per cent power factor main generator and an auxiliary generator rated at 4,000 kva., 70 per cent power factor, with direct-connected exciter. The turbines are of the twenty-stage, single-cylinder type, 1,500 r.p.m., designed for four-point bleed, and have a full-load water rate of 10 lb. per kilowatt-hour without steam extraction. Each condenser has 55,000 sq.ft. of tube surface and is served by two 35,000-g.p.m. circulating pumps. The intake tunnels are 1,100 ft. long and besides having settling basins to eliminate sand are built in parallel sections for dry-pumping to kill marine growths.

The main generators are 50-cycle, 11,000-volt, three-



One-Line Wiring Diagram, Plant No. 2

As shown in the accompanying diagram, Long Beach plant No. 2 is tied in with station No. 1 to make available reserve auxiliary power when needed. The new switch house serves both station No. 1 and station No. 2 and contains the 72-kv. buses and switch gear for both stations. All excitation breakers are operated from the main control board in the switch house, as are the breakers for the generators and bus sections. Feeder breakers are hand operated.



Cross-Section of Plant No. 2 and Switch House

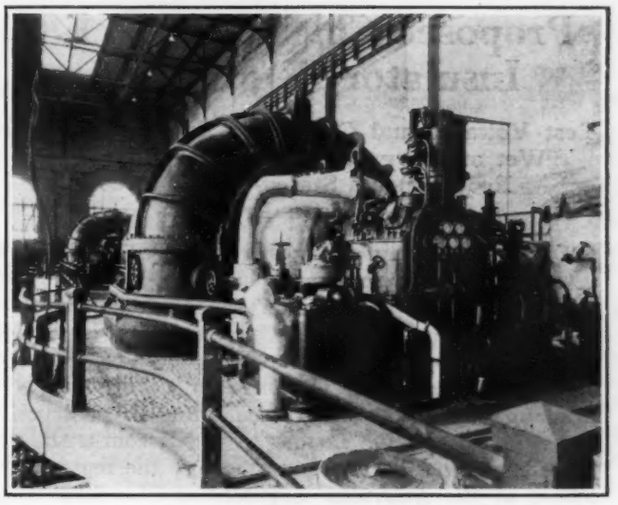
Showing relative locations of turbine room, boiler room and switch house from which plants Nos. 1 and 2 are operated. Fuel, either natural gas or oil, as required is supplied through underground pipe lines. Condensing water is obtained through tunnels 1,100 ft. long from the Pacific Ocean.

phase, star-connected. The auxiliary generators are 50-cycle, 2,300-volt, three-phase. Exciter breakers are non-automatic except on reverse current, and field breakers are non-automatic except that they are tripped immediately after the generator breakers are opened in case the balanced relays of the generators are actuated. All excitation breakers are operated from the main control board in the switch house. Reserve auxiliary power is available from station No. 1, and provision is made for a future reserve auxiliary generator if needed. The neutrals of the auxiliary generators are ungrounded in order to minimize interruptions on the auxiliary power system. Virtually all station auxiliaries are motor-driven and served from a sectionalized ring-bus truck-type switchboard which is located in the boiler-room basement.

The breakers for the generators and bus sections are controlled from the main control board in the switch house, while feeder breakers are hand-operated. In general a feeder serves two motors, the motors being so grouped that the cutting out of any feeder or bus section will not seriously affect complete operation. The smaller motors (440-volt) are served by duplicate transformer banks, and in like manner duplicate lighting transformers are installed.

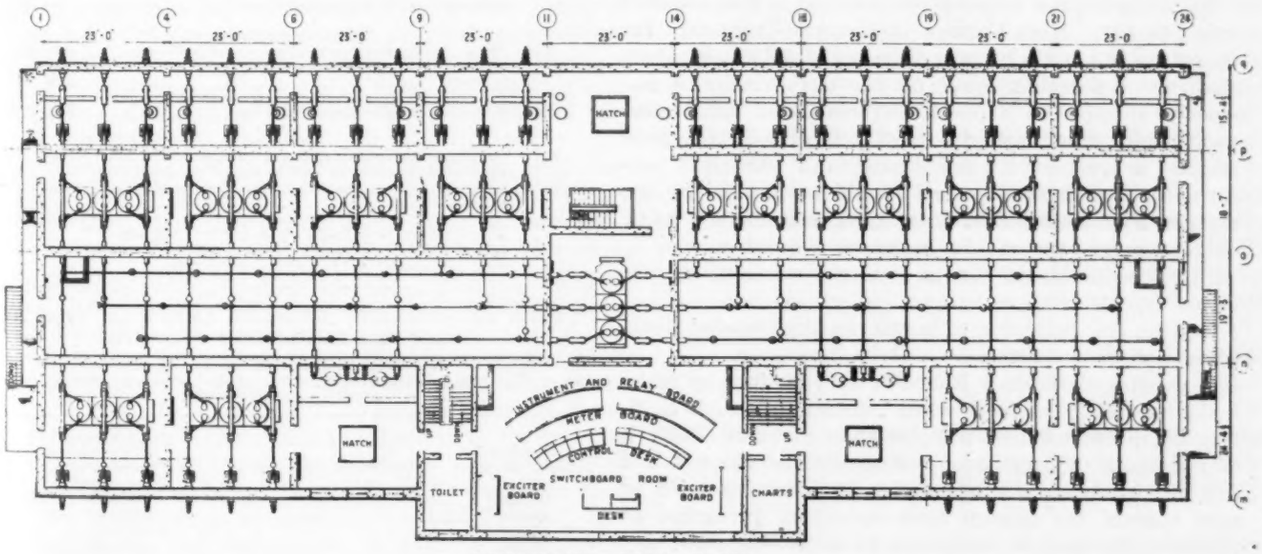
LIGHTING EQUIPMENT

The turbine room is lighted by high-capacity industrial-type prismatic glass fixtures mounted above the crane. Double cast-iron brackets with "Monax" spherical globes and small lamps are installed on columns. The condenser and boiler rooms and switch house are lighted chiefly by "RLM" reflectors and marine-type guarded brackets with frosted outer globes. In the switchboard room a semi-indirect fixture with a small downward component is used.

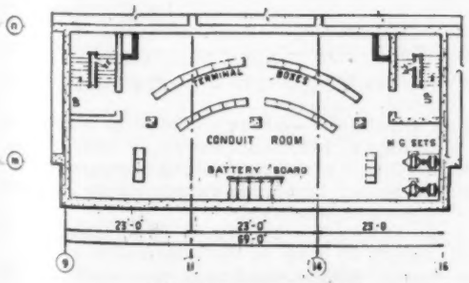


ONE OF THE 35,000-KW. TURBINES

The switch house contains the 72-kv. buses and switch gear for both stations. Duplicate sectionalizing buses are provided, one on each of two main floors. Oil breakers are all piped to purifying equipment on the first floor and to tanks in the yard. Control and instrument wiring passes through terminal boxes installed in a conduit room under the switchboard room, greatly facilitating distribution and combination of circuits. All control, operating and instrument buses and interpanel cross-connections are placed in the terminal boxes and segregated by barriers to simplify the switchboard wiring.

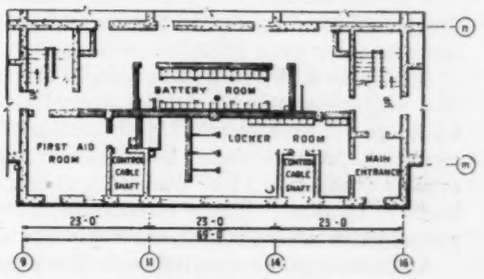


SWITCHBOARD ROOM FLOOR



CONDUIT ROOM FLOOR

PLAN OF SWITCH HOUSE



BATTERY ROOM FLOOR

Proposed Changes in N. E. C. Insulator Requirements

Test Voltages and Correction Factors Specified—Wet and Dry Tests Eliminated—Crossing Requirements Stated—A. E. S. C. to Pass Upon Proposals

SOME interesting changes regarding insulator requirements are recommended by the executive committee charged with revising the National Electrical Safety Code to make it comply more nearly with modern practice without being unnecessarily burdensome or restrictive to progress. The principal changes apply to insulators for guy wires, Grades A and B construction, strain insulators, and factory tests. Of course the proposed changes will have to go through the regular procedure of the American Engineering Standards Committee before they become accepted national standards.

Regarding insulating of guy wires, the wording has been changed to read: Rule 213 (2). Where Required—Except as noted below, each guy wire or guy cable attached to any pole or structure carrying supply conductors of more than 300 volts to ground, and not more than 15,000 volts *between conductors*, or where exposed to such voltage by other lines, shall be equipped with an insulator *that has a dry flashover value double the nominal line voltage and a wet flashover voltage as high as nominal line voltage between conductors, and when applied to lines of Grades A and B construction that is made by the wet porcelain process or a process equally suitable as regards electrical and mechanical qualities, located not less than 8 ft. nor more than 10 ft above the ground.*

Affecting Grades A and B construction is the reworded rule 247 *(a)*. High-Voltage Insulators—Insulators for operation on supply lines at voltages of *2,300 and above* shall be of porcelain *made by the wet process or one equally suitable as regards electrical and mechanical qualities*, or other material which will give equally good results in respect to mechanical and electrical performance and durability and should be marked by the marker with a classification number and maker's name or trademark, the marks being so applied as not to reduce the electrical or mechanical strength of the insulator.

Section *(c)*, referring to insulators at grounded structures, has been deleted.

According to revised Rule 247 *(e)*, on factory tests, insulators shall flashover when tested under A. I. E. E. specifications at values not less than given in Table I, of minimum dry flashover voltages. The old wet and dry test voltages have been deleted. Each insulator or part thereof for use on lines operating in excess of 15,000 volts shall be subjected to a routine flash dry test at the factory for a period of three minutes at a frequency of sixty cycles per second or any other test sanctioned by good practice.

A notable addition to the code is the table of correction factors applicable to the preceding minimum dry flashover voltages in selecting insulators for lines where conditions depart from those under which the table applies (condition 1) or where the characteristics of the line are unusual. These corrections, given in Table II, are additive where conditions apply simultaneously.

At crossings the requirements for protection against arcing will be considered as being complied with if construction in accordance with the following methods is used:

(1) *Pin-type Insulators*—Where pin insulators are used, crossarms, pins, insulators and conductor fastenings are to be double on crossing supports.

For those having:

Wood pins, insulators are to meet minimum values of Table I.

Metal pins, grounded or non-grounded, and wood pins, grounded, used throughout the line, insulators to have a rating 25 per cent greater than requirements of Table I.

Metal pins, non-grounded at crossing supports, non-grounded wood pins elsewhere; or wood or metal pins, grounded used at the crossing supports only, insulators are to have a rating 50 per cent greater than those in remainder of line, but not less than 25 per cent greater than requirements of Table I.

(2) *Suspension Insulators*—Where suspension insulators are used, double strings of insulators should be used on the crossing support except as noted in the fifth paragraph following. Crossarms should be double except where latticed or trussed-steel crossarms are used.

Insulators of the suspension type used on crossing supports preferably should be used in the suspension or semi-strain position except where conditions are such as to require the insulators to be used in the full strain position.

TABLE I—TEST VOLTAGE REQUIREMENTS

Nominal Line Voltage	Minimum Test Dry Flashover Voltage	Nominal Line Voltage	Minimum Test Dry Flashover Voltage
750	5,000	55,000	150,000
2,300	20,000	66,000	175,000
4,000	30,000	88,000	220,000
6,600	40,000	110,000	315,000
11,000	50,000	132,000	390,000
22,000	75,000	150,000	420,000
33,000	100,000	200,000	560,000
44,000	125,000		

TABLE II—CORRECTION FACTORS FOR USE WITH MINIMUM TEST
Dry Flashover Voltage

Condition Number		Correction Factor
	Basic Conditions	
1	Intermittent rains, moderate lightning on system of average extent, with grounded neutral, in open country; pin-type insulators with wooden pins or suspension-type insulators	None
	Atmospheric Conditions	
2	Long dry season with heavy dust accumulation followed by moisture, with system conditions as in (1)	Add 10 to 20%
3	Unusually heavy lightning	Add 10%
4	Chemical deposits, cement dust, excessive smoke, or proximity to sea where subject to salt fogs. All steam railroad crossings are considered smoky situations to the extent of a 25 per cent increment	Add locally 25 to 100%
	System Characteristics	
5	Metal pins where pin-type insulators are used	Add 10%
6	System with ungrounded neutral if less than 300 miles in extent	Add 10%
7	System with ungrounded neutral if length of interconnected circuits exceeds 300 miles	Add 20%
	Crossings	
8	Crossings over steam railroads or signal lines other than minor signal lines, with grounded or metallic pin or crossarm construction, but where line elsewhere is of wood pin construction	Add at crossing supports 25%
	This item does not apply if entire line uses suspension-type insulators. This item does not apply if the construction suggested in rule 247 (g) is followed.	

TABLE III—CURRENT AVERAGE AMERICAN PRACTICE TEST DRY FLASHOVER VOLTAGES

The range of flashover voltages is based on intermittent rains, heavy lightning, extensive system, metal pins, grounded neutral system open country.

Nominal Line Voltage	American Practice Dry Flashover Voltages From	To
22,000	90,000	115,000
33,000	110,000	135,000
44,000	135,000	155,000
55,000	165,000	180,000
66,000	185,000	200,000
88,000	230,000	280,000
110,000	340,000	380,000
132,000	420,000	460,000

Where supported on:

A. Underground crossing supports—insulators are to meet the requirements of Table I. In all cases the insulation at the crossing should be at least equal to that elsewhere in the line.

B. Grounded supports—where supports throughout the lines are grounded, insulators are to meet the requirements of table with one extra unit in each string normally requiring five or less and two extra units in each string normally requiring six or more. In all cases the insulation at the crossing should be at least equal to that elsewhere in the line.

C. Grounded supports at crossing only—insulator strings should have an extra unit where the strings in other portions of the line normally have five or less and two extra units where the strings elsewhere in the line have six or more units. In all cases the insulators should meet requirements of paragraph *B* above.

Where it is preferable, single strings of insulators may be used if all the following conditions obtain:

(1) Metal supports.

(2) Hardware throughout provides not less than a factor of safety of 2 against the assumed maximum tension in the conductor in one direction.

(3) A high-strength clamp which will prevent the conductor under assumed maximum loading conditions from slipping into the crossing span.

(4) An extra unit where strings of five or less are used elsewhere in the line and two extra units where strings of six or more are normally used, in addition to those stipulated under *A*, *B* or *C*, above.

The requirements above apply to insulators used in the suspension position. Where used in the strain position, one more unit should be used in each string than is stipulated above.

In no case shall the application of above paragraphs result in the addition of more than two disks to strings normally requiring five or less and no more than three disks to strings normally requiring six or more.

The sub-committee on insulators recommends that a table of current average American practice (Table III) be inserted as information in the discussion of the National Electrical Safety Code.

Benefits of Industrial Electric Heating

By N. R. Stansel
Industrial Engineering Department, General Electric Company, Schenectady, N. Y.

IT IS estimated by the industrial electric heating committee of the N.E.L.A. that the industrial heating load as a whole produces about $75 per year per kilowatt of station demand and, further, that the miscellaneous small units—constituting one-third of the present heating load—yield returns of about $100 per year per kilowatt of station demand. In the N.E.L.A. *Bulletin* of September, 1924, is the statement that 1 kw. of industrial heating yields on the average twice the revenue of 1 kw. of motor load. A recent report from a central-station company of moderate size having a well-developed motor load advises that its revenue from an electric-heating installation is $40 per year per kilowatt and that from its motor load averages $26 per year per kilowatt.

These figures are interesting in connection with the general subject of the value to the central-station industry of the industrial heating load. It is believed that the data so far obtained justify an analysis by each central station of the heating load that can be developed, and the adoption of heat as a standard item in load building.

The annual return per dollar invested is the basis for comparison of the values of different loads. This value of a load to the central station depends upon its characteristics, and these include that portion of the twenty-four-hour period in which it occurs. The engineer expresses this value as the ratio of the average load to the station demand—that is, the load factor. The executive has this same value in mind in considering the ratio of the gross returns to the capital invested.

An analysis of the figures of the central-station industry during the past ten or fifteen years shows a material increase in the returns per dollar invested, and that period covers the growth of the power load as an addition to the lighting load. A load of a different character was also added with good results in a financial way. Industrial heating, as another profitable load to increase further the returns per dollar invested, is now a subject of much interest to the industry.

The present industrial heating load is estimated to be about two billion kilowatt-hours per annum. Much, therefore, has already been accomplished. In an article entitled "Industrial Electric Heating," N.E.L.A. *Bulletin*, March, 1925, F. A. Coffin estimates that the potential industrial heating load in the central-station field of this country is twenty-five billion kilowatt-hours per annum. Statistics compiled by the ELECTRICAL WORLD give the total rating of the generators now installed in the central-station plants as 20,600,000 kw. On a flat load curve basis these machines would produce about 180,000,000,000 kilowatt-hours per year. It is necessary, however, to consider but a fraction of this total. In spite of this, there is a sufficiently wide margin between the approximately fifty billion kilowatt-hours generated in 1924 (and with much less generator capacity) and the attainable output today to admit into the industry all of the estimated potential heating load.

However interesting these general figures may be to the individual executive, and however willing he may be to grant the technical feasibility of heating by electric energy, it is necessary for him to know that the industrial heating load is a profitable undertaking for his plant before he accords a full and enthusiastic acceptance to the idea.

The large part of this load today and in the future is the resistor type furnace, oven and smaller heating units, and only this type of load is here considered. This class of equipment has been developed into standard forms, is simple and is adaptable to a wide range of industrial heat processes. It is thus particularly well suited to central-station exploitation.

In some cases local conditions may offset some factors of value in the heating load. In general, however, the elements that make the heating load financially desirable can be summarized as follows:

(*a*) The resistor type heating load requires no extra current for its support; all the current taken by the load is revenue current. The addition of this type of heating load to a system operating at less than unity power factor—as is generally the case—does not increase the total current by the same amount as is added in revenue current, and the larger the amount of extra current that is circulating in the system (that is, the lower the power factor) the more advantageous is this addition of heating load. Thus the building of a

composite power load of motors and heating apparatus tends toward a natural solution of the power factor problem.

(*b*) Heating is inherently a continuous process. During the period of operation the factor of heat storage comes into play to a greater or less degree, depending upon the type of apparatus, so that while in many cases the energy input is not continuous, the general nature of the load is very favorable in this respect.

(*c*) Heating processes, in many cases, can be readily carried on at other hours than the regular working period of the day and can be suited to the load chart of the station. Off-peak utilization offers a promise of wide development by the heating load. It seems pertinent here to refer to what appears to be a probable phase of electric heat—the storage of heat energy. The factor of sleep is a bar to filling the valley of the load chart after midnight except by storage of energy in some form. The results that have been obtained in the storage of heat by electric current (principally abroad) are attractive and must be of much interest to the central-station industry.

(*d*) The maximum demand is definite, being fixed by the rating of the apparatus, and, for a group of heating units, can perhaps be more readily determined than for any other type of load.

(*e*) The voltage regulation requirements of the heating load are simple and not exacting. The continuous storage of heat—so far as the heating equipment is concerned—is a useful voltage equalizer.

(*f*) The heating load fits a wide range of customers' requirements, both large and small, the heating equipment being capable of subdivision into units as may be needed for any installation. The smaller units can be placed on the system without great effort, and a considerable volume can thus be added without a corresponding increase in distribution expense.

(*g*) As far as the resistor type heating load is concerned, there is no need of a "power factor clause" and, as previously stated, with the growth of the heating load the power factor situation becomes of less and less concern and the motor load becomes more and more desirable. Thus there would be less requirements to be met by customers adding that much to the effectiveness of power salesmen.

ELECTRIC HEATING MUST BENEFIT USER

All these elements are factors in the value of the industrial heating load to the central station. The executive, however, is not concerned with this viewpoint only. Service of any character must be valuable to the user or it will not exist for the central station. Therefore, in addition to an appraisal of the value of electric heat to his stockholders, the plant manager must see clearly the value of electric heat to its users.

It is easy to consider the chain of events from the boiler plant of the central station to the electric furnace in the industrial plant as being a wide gap between heat generated and heat utilized. Familiarity with efficiencies of around 75 per cent to 80 per cent as obtained in the boiler plant may lead one to assume this same efficiency for a combustion type industrial furnace. In the boiler plant the hot gases have good opportunity to give up their heat to water, and leave at a comparatively low temperature. In the combustion type industrial furnace the material being heated is at about the same temperature as that of the hot gases, and these gases must leave the furnace not much below the temperature of combustion; so the efficiency of this type of furnace is of a very low order, around 5 to 10 per cent. Hence the conversion of heat to electric energy and back again to heat is not a backward step in economics, as might be inferred if these differences in efficiencies in the utilization of heat direct from combustion were not taken into account.

A convenient way to analyze the value of heat from the user's viewpoint is the not complicated expression

$$V = \frac{s \times n \times c}{i + m + l + e + r}$$

V = the comparative value of a method of heating.
i = capital charge on the user's investment.
m = maintenance charge.
l = labor charge.
e = cost of heat units (B.t.u.).
r = cost of raw materials, including cost of rejected pieces.
s = sales value of a unit product, including the element of quality.
n = number of units produced in the given time.
c = the factor of convenience.

NOTE—Item m includes all accessory equipment.

For different forms of heat the elements which make up this ratio have different values, and by substituting the value that pertains to each form of heat under consideration for each item, comparative values are obtained which will disclose the relation that the cost of heat bears to the value of the product.

FALLACY OF COMPARING B.T.U. COSTS

The central station is interested in this analysis, because it exhibits the extent to which the cost of the heat units influences the cost of production. The competitor of electric heat is fuel in one form or another, but the value of electric heat to the user is not obtained by placing the rate for electric power alongside the cost of fuel.

The development of industrial electric heating is proceeding along lines similar to progress in the application of electric power to machinery. In the early days the motor user saw only the difference between the bill for electric power and his former cost of fuel, naturally believing the two to be comparable. A little time elapsed before the value of the resultant savings and advantages of electric power were understood in terms of money. Today in the same way the first thought in considering electric heat is usually an effort to make a comparison between these two totally different quantities. Those interested in the use of electric heat within its economic field can be of much service both to the user and to the maker of electric power if they determine first of all just what bearing the cost of heat units has upon the cost of the work to be done.

The factor of convenience, while it cannot be expressed in dollars, is often the deciding influence, making further analysis unnecessary. Convenience includes freedom as to time and place of operation; elimination of combustion (combustion is not the main intent of the industrial operation), flexibility of heat application, the lack of which is a serious limitation of the combustion method, and freedom from trying working conditions that are a part of heating by fire.

The two factors of convenience in application and quality of output have perhaps more influence on the growth in the use of electric heat than its several other advantageous qualities. These need not be repeated here. That electric heat is a superior tool of industry is well established. To the central station, heat is another form for the use of electric energy in the same diversified way that is characteristic of the use of power made possible by the electric motor.

A Review of the Development of the Electric Light and Power Industry 1920-1930

By DAVID COWAN
Montreal, Canada

IN DETERMINING the cause for the phenomenal development of the electric light and power industry during the period 1920-1930 we must fully appreciate that a large proportion of such progress has been due to far-reaching engineering achievements attained during this period. It would indeed be interesting to speculate on the reason for the extremely rapid yearly increase in the efficiency and economy in the methods of producing electric power. Whether we ascribe it to the insistent demand of the plant owner upon the engineer for more and lower cost power or whether the engineer has been the leader in the field and the owner the beneficiary matters little. The fact remains that improvements on the technical side have been definite in their tendency always toward increased magnitude of equipment in general, with a view to more economical operation.

Substantially the greater part of the electrical energy generated by central stations has, in the United States, continued to be furnished by the steam power plant. Although rapid progress has been made in the intensive development of water powers during the same period, the steam power plant still leads in output.

Steam-electric plants have steadily progressed in point of size, and whereas ten years ago a 165,000-kw. station was considered a large installation, there are stations completed within the past three years for a capacity of over 600,000 kw. In considering size of individual generating units it is interesting to note that increases in the kilowatt capacity occurred chiefly during the period from 1920-1924, when in four years' time the limit of generating unit size grew from 35,000 kw. to 60,000 kw. The last four years have not been productive of so many changes in this field, as it has been found that size is not of itself the most important feature, the choice rather depending upon the special problems met with in each station, where in some cases the largest generating unit is not always productive of the greatest economy.

The use of various appliances for utilizing the waste heat losses and the use of high pressure and high temperature steam, operating in so-called reheating and regenerative heat cycles, have resulted in increased over-all thermal efficiencies far above those obtainable without these refinements. In 1923 the average large generating plant turned out a kilowatt on 2.4 lb. of coal as compared with 3.2 lb. in 1920. The most efficient plants in 1924 reduced this figure to 1.3 lb., while present-day plants have obtained a kilowatt on 1 lb. of coal. Further large economies have been instituted during the decade by fuller advantage being taken of such thermal systems of operation as stage-bleeding, reheating and utilization of heat in the waste gases.

Steam boilers have had a more diversified development than any other section of the plant. Steam pressures which in 1920 averaged 300 to 350 lb. per square inch, by 1925 had increased to 550 and 600 lb., with one or two instances of what could then be termed experimental installations operating commercially at 1,200 lb. per square inch, notably in the Weymouth station of the Edison Electric Illuminating Company of Boston. The efficient results obtained from these first installations, establishing the economies theoretically to be gained from high pressures and temperatures, account for the number of plants today operating at from 600 to 1,000 lb. per square inch pressure. The theoretical economies claimed for plants operating on the Benson super-pressure or the Emmett mercury steam principle have been put to test in certain experimental plants, but the general adoption of these systems awaits actual proof of heat economy as against increased cost of installation and reliability of operation. It may be of interest here to remark that although the design of materials has kept pace with steam pressures, the limit of temperature appears to have been reached for metals at present available.

The greatest single item of expense in the production of steam power is necessarily the cost of fuel, and engineering talent has been specially directed toward the design of fuel and labor-saving equipment. Among the natural solid fuels coal has continued to be the leader, although we must note that the firing of coal in powdered form has largely supplanted stoker firing for large plants burning low-grade bituminous coal, anthracite culm and lignite. Where load factor is very low and stand-by losses correspondingly high, powdered fuel has offered advantages over stoker firing. A number of isolated plants, favorably located, have combined the burning of powdered coal with blast furnace gas. The mechanical stoker, however, still continues to hold

THIS paper won the first prize of $5,000 in the recent contest of Bonbright & Company, New York, as the best combined review and forecast of the electric light and power industry for the decade 1920-1930. Names of the other prize winners and a note concerning Mr. Cowan were printed in the *Electrical World* for June 20, page 1358. As there stated, a further cash award of $10,000 will be made five years hence to "that contestant whose paper, reviewed again in 1930, shall appear to have most nearly approximated the facts as they eventuate." All the 438 papers submitted will, by the terms of the contest, be eligible for this additional capital prize.

its own, especially in the burning of good-grade bituminous coal, anthracite and coke breeze, while the assistance of properly designed furnaces, with ventilated walls and preheated air, has given results very close to those attributed to powdered coal.

However, in the production of electric power, the use of one or the other fuel or even the preference for hydro-electric installation has been entirely governed by one of these which will most economically serve to generate energy for a given locality over the longest time period. It has not, as might be supposed, been dependent on the relative individual cost at a given time of any one of these methods. Thus on the Pacific Coast we find that oil fuel can be purchased for less than coal based on equal heating values and that a steam plant in the oil field section can be built for use with fuel oil for less than a hydro-electric unit, yet steam stations are there found merely as supplements to hydro-electric plants for use during periods of low water or excessive demand. In the coal-producing zones such as in Pennsylvania and Illinois, where also exist the greatest industrial centers, coal has successfully withstood the competition of any other fuel.

Diesel type engines using oil, though requiring less fuel than any other type of prime mover, have not been installed in America for large central stations. This is partly due to the comparatively low capacity of even the largest units and the consequent necessity for greater space requirements to permit of the installation of a number of such prime movers.

Although in the U.S.A. political discussions may be considered to have retarded a more thorough exploitation of water powers, developments in this field have paralleled the improvements in design and construction observed for steam plants. The progress so made may be observed by noting that whereas in 1920 the total kilovolt-ampere generator rating for the United States was 5,628,000, this figure has since grown to about 11,500,000 kva. as at present. This progress has been continuous throughout the period, the total rating of hydro-electric generators in the United States for 1925 having been 8,093,000 kva.

Here it might be interposed that in Canada it is well known that the hydro-electric station has been consistently the leader in the past ten years for the production of power. There were in 1920, 2,500,000 hp. of waterwheel and turbine installations, the increase being continuous to 4,000,000 hp. in 1925 up to the present figure of 5,200,000 hp.

Average capacity of generator units has similarly traveled in an upward direction from the 30,000-hp. machines constructed in 1920 to the 70,000-hp. wheels installed in the Niagara Falls Company's plant in 1925. Changes since that date have been far less rapid, as activities have been confined to the study of economies to be gained from such installations, which at that time were considered to be more or less experimental in nature. A special study of draft-tube design has, moreover, developed an ejector type which maintains the output at normal rating during the flood season when the effective head is reduced.

Several installations are now recorded of high-speed propeller turbines operating under 50 to 60 ft. head at 130 to 140 r.p.m. with good results under a wide range of heads and applied to units of large capacity, as in the case of four units each rated at 30,000 hp. installed by the St. Maurice Power Company in 1924.

Continual refinement in the design of vertical wheels and thrust bearings has caused the almost complete disappearance in hydro plants of the horizontal type turbine, except in units of 1,500 hp. or less.

A remarkable feature has been the increase in the number and size of hydro-electric stations remotely or automatically controlled, particularly in the case of power sites of small capacity where high operating costs were against this class of development. Since 1924 this side of hydro-electric engineering has been given its deserved attention and there is now installed one or more automatic stations in every state of the Union. A leading installation is that of the Adirondack Power & Light Corporation for its Sprite Creek development near Little Falls, N. Y.

The automatic railway substation has made it possible to make electric railway systems completely self-operated by providing automatic control of all substation units. Such developments have made demands on the constructional details of transformers, switching equipment and the less important accessories, which have also undergone corresponding modifications in design.

Reference should here be made to the increased use of electric boilers and the large capacity of some of the units now in operation. In the case of industries or heating plants located close to abundant water power, it has been found economical to use off-peak power to generate heating or process steam from hydro-electric power in specially constructed boilers. This method of generating steam has provided an efficient way of utilizing surplus power in case of hydro-electric plants, and in one instance at least, that of the Winnipeg hydro-electric and central heating plant installed in 1924, considerable revenue has been gained from the sale of such steam for heating purposes.

LOWER POWER COSTS

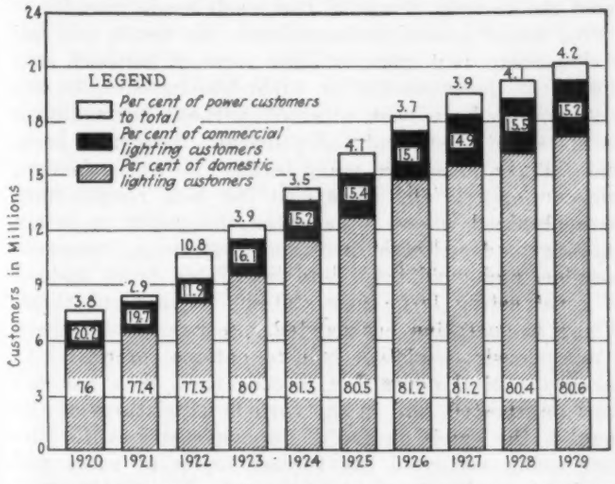
One cannot read of great technical achievements to lower power costs without concluding that an even greater centralization of power generation has been a feature of the past decade. The effect of this tendency on the individual industrial power house is interesting to examine, for the isolated unit has in fact always constituted a peculiar problem in utility engineering. While one has already noted the ever-increasing size of central-station equipment, with attendant reduction in generating costs, and with savings in transmission and distribution, the habitual small average capacity of the isolated unit has necessarily precluded the incorporation of the larger part of these refinements in power production methods as they were devised.

Cheaper power rates have undoubtedly encouraged the further use of central-station energy by large industrial consumers, especially during the last five years, but it would be wrong to gain the impression that the tendency has been toward a complete disappearance of the isolated unit as an adjunct of American industry. True, where requirements have been for 500 hp. or thereabouts, it has undoubtedly been practical for plants to use central-station energy where such is available at usual rates. On the other hand, it is well to note that factories requiring 500 hp. or more have in many cases found it economical to retain their own stations, even though maintaining connected lines from central systems for exigencies of load irregularities. Especially has this practice been true in the case of industries where steam must be employed for certain processes and operations.

After stating in brief outline the technical devel-

opments that have characterized the past decade, it is impossible completely to leave this aspect of the subject without dealing at some length with the great achievements in distribution methods encompassed within this same period. This end of the electric light and power industry requires special attention at this moment, for just as the period from 1910-1920 could well be termed an age of fundamental engineering achievements, so the ten years now under review could be specifically known as "the age of perfected distribution."

As is well known in the earlier days of the industry it was an unusual occurrence for a power house to be located near the load, and it was this practice which caused many an older station in 1920, especially the isolated unit serving an industrial plant, to be uneconomically located with respect to the zone of power demand. For some years previous to this date it had been perceived that it would ultimately become much



TOTAL CUSTOMERS OF CENTRAL-STATION COMPANIES, 1920-1930

more economical to transmit energy from a unit or group of units located, above all, with regard to the availability of hydro power, or coal and condensing water.

Power development from 1920-1924 was consequently largely along these lines, with the natural result that engineering interest became centered chiefly on longer distances of transmission at higher voltages. When distribution of power up to 300 miles at high voltages, without undue loss, became a practical possibility, when the establishment of a 220,000-volt transmission system by both the Southern California Edison and the Pacific Gas & Electric Company in 1923 passed its experimental stages and showed what economies could be effected thereby, a great impetus was given to long-distance transmission of electricity. Coupled to this feature was the fact that transmission lines cost about one-tenth as much per kilowatt as a generating station, and it was then natural to conclude that with technical difficulties overcome the cost of electricity to the consumer would be greatly lessened by the building of extensive transmission lines connecting power houses, these in turn to act as reserve to one another during periods of local shortage or other emergency.

This feature is by no means a recent one, nor is its origin to be found within the past decade, since a system of interconnection was inaugurated by the Public Service Corporation of Northern Illinois as early as 1902. What does properly belong to this period, however, is the actual putting into practice of a great system of distribution over hundreds of miles through the interconnected wires of entirely independent companies.

After the deflation period of 1921 it became a matter of serious discussion among public utility operators as to what was to be done in order to cope with the tremendous demand for power manifesting itself—a demand which, up to then, had practically kept on doubling itself in each five-year period. With commodity prices once more rising, great economies had necessarily to be effected in the industry as a whole, if it could show itself capable of adequately meeting this demand and at the same time of defeating the ends of public ownership advocates. It became plainly evident that it was just as inefficient for three or four different companies to supply power within a radius of 200 miles or so as it would be for freight and passenger traffic to be cared for in that same district by four separate railroads, with their individual stations, equipment and executive offices. It is, therefore, in this preconceived and well-defined tendency toward consolidation, as carried on soon after 1921, that we can discern the real beginnings of the "giant power" and "super-power" systems so common today throughout the country.

While both these terms have been used to convey the same meaning it has been usual to refer to "giant power" as the transmission of electricity over great distances from large generating stations located at the coal mine; "super-power," on the other hand, is commonly used to describe the great network of interconnected lines of different companies whereby an extensive area is given power facilities, with the least possible wastage. The complete interconnection within the past three years, despite the early opposition of the Pennsylvania Legislature, of giant power plants in Pennsylvania with existing hydro-electric and steam units on the Atlantic seaboard and in New England to form a super-power system for the whole northeastern section of the United States forms one of the remarkable steps in the development of distribution. In fact, the establishment of super-power systems throughout the country can well be regarded as a milestone in the history not only of the electric light and power industry but of the United States as well on account of the economic and social changes it has wrought and will to a still greater extent in the future. The present system of interconnected wires, covering, if not the whole country, at least the industrialized and more densely populated sections, so that service can be relayed to a needed point upon almost an instant's notice, cannot but have more than a passing effect on a nation's commerce and industry.

The linking together of great power systems, as briefly defined above, has been scientifically developed in order to make economic usage of what might be termed "natural super-power zones" in various sections of the country. The greatest of these "super-power" districts at present are the Adirondack-New England system, connected with middle Atlantic stations to form a continuous transmission system in a territory bounded by northern New England, District of Columbia and the western boundary of New York State; another such zone comprises the states of Alabama, Tennessee, Georgia and the Carolinas, where the interconnected companies include such large units as the Tennessee Electric Power, Southern Power, Alabama Power, Georgia Railway & Power, Columbus Electric

& Power, and Carolina Power & Light; another is found in the Middle West, with the great Insull properties of Illinois and adjacent states as the center of the pool, while still another zone is seen on the Pacific Coast, where the interconnected lines of the Southern California Edison, the Pacific Gas & Electric, the Puget Sound Power & Light and others form a complete power system from the Mexican border to British Columbia and east as far as Montana.

We are accustomed to regard these today as established features of the industry, but it should be borne in mind that only five years ago much work still remained for accomplishment.

GROWTH OF SUPER-POWER

The first localities to be successful covered by a super-power system were those where large companies already operated in an extensive field without competition—in many cases the less densely populated but rapidly expanding sections of the country. Thus the South and West, by the close of 1924, each possessed a super-power system similar in practically all respects to that existing today, for at that time the interconnecting of four or five large units immediately resulted in a network of distribution extending over hundreds of square miles. The zones in the Middle West (apart from the Commonwealth Edison's and other Insull properties' power pool, which was established very early in the decade, but may now be considered as then relatively local in scope) and on the Atlantic seaboard have been of more recent accomplishment, owing largely to the number of independent plants in thickly populated sections that required to be amalgamated or merged with existing corporations, before large-scale interconnection could be possible on a profitable basis.

During the years 1923 and 1924 there was witnessed tremendous activity in this direction—a period when independent properties were being rapidly acquired by operating companies, while large interests were trading properties in order to get a better geographical distribution of their holdings.

The advantages of interconnection have been made known in so many forms that they require but scant mention in this brief survey. The economies effected are such as always accompany consolidations, mergers, and large-scale operations of all kinds, provided these are firmly based on sound principles and directed by efficient management. Super-power has instituted great savings due to the cheaper generation and distribution of power; it has given a certainty of steady service; has aided in the conservation of the country's diminishing fuel supplies; has made possible the utilization of unharnessed water powers; and has substantially reduced generation costs through the joint economic use of steam and water power. Moreover, whereas earlier in the decade agricultural communities found themselves more or less isolated with respect to power facilities, constant electrical service at a reasonable cost is now within the reach of all farmers in well settled country districts. Facilities have in addition been given for the electrification of railroads, about which more is said elsewhere.

There has appeared in some quarters a feeling of disappointment owing to the lack of attainment of great projects which many enthusiastic persons believed would be in practice today. Many were inclined to believe, not many years ago, that a great national power system under single control extending from coast to coast would be a reality by 1930. The fact that large independent companies would exist, amid a network of interconnection, seemed to many an anomaly, but a study of the nature and limitations of industry should prove otherwise. There is a distinct end to the economies that can be effected by consolidation, and it is impossible to conceive how any greater service than given at present could be instituted by establishing a power system under a centralized supervisory management, characteristic of the telephone and telegraph service.

To summarize, it might be said that the rapidity of growth of super-power over the past ten years has resulted from two main factors:

1. On the demand for energy that could not be economically satisfied owing to difficulties in the way of expansion on the part of small public utilities.

2. On the tremendous growth in demand that resulted from the cheaper power it had itself made possible.

One would greatly underestimate the vision and toil of engineers and bankers alike were it believed that the great developments in super-transmission in the past decade have been attained without surmounting barriers, both technical and political. Both have been, and still are, present in many forms. As to the former, one can only briefly state that the best results have been obtained where it has been the policy to retain existing hydro-electric and steam stations, whenever possible, and mold them into integrated units instead of constructing large new stations to supplant these. Where co-operation has existed, super-power has been a marvelously consistent help to national progress. As far as political opposition is concerned such has not been unexpected, and in the various legislatures of the country the catch phrase of super-power has for the time being relegated the former topics of rates and public ownership to the background. In recent years, special attention has been given to the large consolidations which were inevitable if economies were to be reached in the operation of public utilities. Opposition has come chiefly from parties who have been led to believe that the power resources of the country were under the autocratic control of a handful of bankers, and moreover, through an incomplete knowledge of the subject, fail to note that "super-power" is an engineering principle and not any special trade mark of process. It is possible that misconception as to its meaning may have been due in part to the early use of the term in the incorporated titles of certain companies, but in any case one remembers that periods of great scientific progress have frequently been accompanied by a transitory public antagonism. Were it alone for the development of an efficient distribution system, with the almost complete network of interconnected lines extending through the country, there would be sufficient reason to designate the decade from 1920-1930 as an epoch in the development not only of the electric light and power industry alone, but of the commerce and economic structure of the United States as a whole.

UTILIZATION OF CENTRAL-STATION ENERGY

As mentioned in the concluding remarks of the preceding discussion, the rapid expansion in the amount of business transacted by central stations has been one of the outstanding features of the past ten years. In attempting to explain the reasons for this stupendous growth, as indicated by the following figures, one should remember that not only will this year's census

show some 15,000,000 people added to the population of the country since 1920, but consumption per capita has also greatly increased. In addition, the utilization in industrial plants of power generated from central stations has mounted far more rapidly than suggested by the mere growth in the number of customers.

AMOUNT OF ENERGY GENERATED IN THE UNITED STATES

(By central electric light and power stations, by plants of electric railway companies, and certain other systems not classed by Census Bureau as central stations)

	Kilowatt-Hours		Kilowatt-Hours
1929	89,280,000,000	1924	58,996,000,000
1928	83,863,000,000	1923	55,674,000,000
1927	76,325,000,000	1922	47,659,000,000
1926	69,250,000,000	1921	40,976,000,000
1925	64,750,000,000	1920	43,550,000,000

The electric light and power industry could scarcely have been regarded in 1920 as of recent origin, yet it is remarkable that there were in that year only 5,750,000 residential lighting customers, or about one-third of the total potential number at that time, estimated at about 17,000,000. Similarly, industrial power customers totaled 280,000, as compared with an estimated potential market of 925,000. The following figures illustrate the steady increase of central-station customers in the United States over the past ten years.

LIGHTING AND POWER CUSTOMERS OF CENTRAL STATIONS IN U. S. A.

As of January 1	Residential Lighting Customers	Commercial Lighting Customers	Power Customers	Total
1929	17,148,530	3,255,000	866,470	21,270,000
1928	16,337,675	3,162,000	800,325	20,300,000
1927	15,765,000	2,900,000	735,000	19,400,000
1926	14,745,300	2,750,000	675,000	18,170,300
1925	13,252,985	2,524,705	599,915	16,377,605
1924	11,772,600	2,200,000	505,000	14,477,600
1923	9,903,800	1,988,000	461,940	12,353,700
1922	8,350,100	1,293,830	429,580	10,794,000
1921	6,517,600	1,675,900	326,840	8,520,400
1920	5,744,800	1,528,300	286,500	7,559,600

(Figures from 1920-1923 inclusive, courtesy of ELECTRICAL WORLD)

A detailed survey of the past ten years' achievements in this sphere of the industry would clearly show that in each year central stations have been successful in reaching and serving an ever greater proportion of their potential market as a result of education, advertising and the institution of better methods of distribution. While it was to be expected that residential lighting customers would show the largest numerical increase, there has been a steady tendency for the central station's connected power load to show a somewhat higher ratio of increase than the connected lighting load. The growth in number of lighting customers has been especially marked in the Middle Atlantic States, in which is included Pennsylvania, New Jersey and New York, and while the growth of industrial load in these states has indeed been large as a result of the superseding of isolated units, the increase in number of industrial consumers appears to have been the greatest in the Middle Western states of Ohio, Michigan, Illinois, Indiana and Wisconsin. A brief insight into the developments in use of electricity by homes and industries should no doubt be interesting in view of the tremendous growth in consumption as indicated by the figures presented in the accompanying tables.

The past decade is notable for the tremendous increase it has shown in the use of electricity in the home. This expansion has been encouraged by the electric supply authorities because load building and a proper balance between lighting and power has always been one of the outstanding problems of the industry. In addition to the ever-improved lighting equipment, electrical appliances are freely used in the home to perform a number of various operations. The electric flatiron was perhaps the first popular device of this nature to find favor and it is now found in practically every home where power is available. Electric toasters, vacuum cleaners, fans, cooking ranges, dishwashers, sewing machines, washing and ironing machines are the more important devices that can be employed in the up-to-date home. Ten years ago the "ice box" was in common use in every home throughout the country, but the modern apartment house and residence have equipped themselves with the electric refrigerators, a much more sanitary device. Of the number of developments in this field, domestic electric heating is probably that which has shown a growth far less than what we expected of it. The electric log or fireplace has for many years provided auxiliary heat in the living room, while, similarly, the portable heater has long been popular because of its portability from room to room as required. Complete domestic heating by electricity is not as yet an economical achievement, and in those parts of the country and in Canada where such use would constitute a large source of profit, the severity of the winters must still preclude for a long time such installation, since heating by coal and oil-burning furnaces can be carried on at a much more reasonable cost.

In dealing with this subject it may be said, however, that central heating by means of electrically generated steam can be, and in fact has been, carried on economically in certain localities where hydro power is abundant.

No less striking has been the increased use of electricity in agricultural communities, and especially is this remarkable in the case of Pacific Coast States. This field has continued to form an exploitable market for power until at present, in California, to cite one instance, over 20 per cent of electrical energy generated is used for agricultural purposes, irrigation and so forth. It is worthy of note that practically all the irrigation pumps used in the vast developments of this nature in California are driven by hydro-electric current supplied from central stations. Modern labor-saving devices have found their way to the farms, where in addition root cutters, cream separators, churns and milking machines are being run by electricity, while in the Southern States electricity similarly drives the cotton gins and baling presses.

The more complete exploitation of such potential markets as briefly outlined above has had the most far-reaching effects on the status of public utility corporations, for the proper amount of attention given to the building up of a residential and agricultural load has found companies strongly intrenched when periods of industrial inactivity have arrived. This has been especially true in the case of the New England district, where, although for many years industrial activity was much below normal, the ever-increasing number of high revenue domestic lighting customers was sufficient to maintain the upward trend of the industry in that locality. The more intensive illumination of streets, made obligatory by legislative authorities as a result of traffic congestion, has also materially benefited the central station, although it happens that much of the increased load has accrued to the benefit of municipally operated power plants.

The use in American industry of electrical power generated from central stations has continued to show rapid strides. For instance, the establishment of the radio industry on a firm basis, which was indeed one of the characteristic features of the period under review, has caused an ever-growing demand for metals such as aluminum and magnesium produced by electrolytic processes, while of great importance has been the increasing use of electricity in the iron and steel industry. It is not possible in such a brief survey as the present to state in detailed form the various industrial markets that have been opened to central stations through the ability to produce energy at extremely low prices. It will suffice to state that throughout the decade the development of unharnessed water powers or the establishment of efficient steam stations have been the precursors of great industrial growth in the districts where these were located. No better instance is seen than in the remarkable transformation that has come over the Southern States. In 1920 this territory still retained many characteristics that must necessarily check any material progress, but the rapid harnessing of water powers and the advent of cheap energy had by 1923 already caused the bulk of textile mill construction to be transferred there, until today the South rivals New England as an industrial center. Another example of what good power facilities can accomplish is noted in the fact that, with all due regard to the availability of raw material, it is abundant and cheap power that has greatly enabled Canada to snatch from the United States the supremacy in world newsprint production.

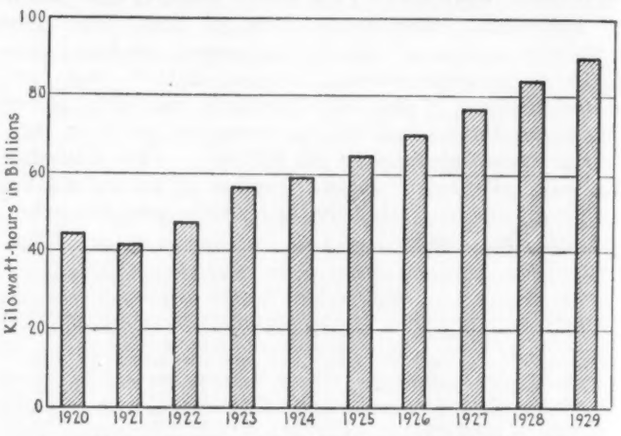
One of the peculiar problems of the industry and that which has always been of absorbing interest to electrical engineers pertains to the electrification of railroads. In 1900 it would scarcely have been considered fantastic to predict that in twenty-five years' time an exceedingly large proportion of the total electrical energy generated would be consumed by railroads, yet in 1925 we find that less than 2 per cent of the railroad mileage of the country was electrified, and an estimate today would scarcely find the proportion materially higher. A long-standing question has been asked—"Why does the long-talked of 'coming of age' of universally electrified railroads fail to come?"

In attempting to answer this question in brief, it should be noted first of all that the primary impelling cause for electrification has been the factor of tunnels and smoke nuisances near cities or, as in the case of the Norfolk & Western, the existence of short congested districts having extremely heavy traffic on restricted trackage, and no alternative but to increase very materially the speed and accelerating capacity of trains. The electrification of terminals in large cities was years ago made compulsory by various legislative bodies, and in 1920 a number of such installations had already existed for some time.

It should be borne in mind, however, that a great proportion of the country's railroad mileage differs from that of foreign countries in that it passes through territories where traffic is not of such extreme density as to require immediate remedy, while the huge initial outlay necessary for the conversion of lines has furthermore continued to favor the steam locomotive for long hauls. It was early recognized that the efficiencies gained in central power houses enables fuel to be burned with an economy not obtainable in an isolated locomotive, but the growth of superpower has gone a long way toward keeping down the costs of fuel and the immediate necessity for conversion has been somewhat postponed.

It would be erroneous to believe, however, that while the proportion of electrified roads is still small, no greater developments in this phase of the industry have occurred during the past ten years. On the contrary, a matter of the most far-reaching importance in central-station operations can be noted. This is the tendency, where terminals are electrified, to use exclusively energy generated from the large central stations of companies operating in that particular territory.

A substantial part of the trackage of the New York Central, the New Haven, and the Pennsylvania Railroad was electrified a number of years ago, but special generating plants were in each case constructed and operated by the roads to furnish the necessary energy. In 1924, however, when it was decided to electrify the terminal of the Illinois Central in Chicago the railroad officials decided that it would constitute a far greater economy to make use of energy wholly generated by the plants of the Commonwealth Edison Company. This installation in its entirety is not yet completed, and it may be considered still premature to judge accurately of the economies attained by this method. However, the recognition at that time by eminent engineers that electrified roads should make full use of established central stations in preference to the construction of special generating units is sufficient in and of itself to constitute a milestone in the development of the public utility enterprise. As more and more trackage becomes electrified, the central station must necessarily reap the benefit to a greater extent than it has ever done in the past.



GROWTH OF ENERGY GENERATED BY CENTRAL-STATION COMPANIES IN UNITED STATES, 1920-1930

Remarks under this heading would scarcely be complete without mention being made of markets offered by traction companies. Probably no other branch of the industry has passed through so many adversities since the first few years of the present century, when high hopes were entertained of the future. Needless to say, excessive political interference, the growth in automobile registrations, and the availability of these to families of moderate means have made inroads into earnings of such companies. While, in truth, the outlook appeared extremely dark in the early years of the past decade, a study of conditions will show that a steady betterment has occurred since 1924 and 1925, especially in the case of tractions constituting an integral part of a general public utility property. Some-

what of this improvement may no doubt be due to the recently observed use of street car facilities by an ever-increasing number of automobile owners, to avoid the inconveniences brought about by dense traffic and the lack of an efficient parking system.

Competition from auto buses and freight trucks was undoubtedly injurious to interurban railways from 1920 to 1923, when practically all states permitted the full use of highways by such commercial vehicles without the imposition of extra taxes, a privilege denied to electric railways. After a later date, however, legislatures came gradually to recognize that interurban trucks were common carriers and, as such, subject to special taxes, with the result that, at present, unfair competition of this nature has largely been removed.

The development by electric tractions, particularly in the Middle West, of interurban freight traffic for distances of over 20 miles, the approximate limit of economic haulage by auto trucks, has been especially noticeable in the past five years. It is indeed surprising how in this department tractions have been able to compete successfully, both as to speed and rates, with established railroads. Operators who in the early years of the decade fully realized all the possibilities that lay ahead and were courageous enough to expend the necessary amount in replacements of antiquated machinery and equipment have already begun to reap the benefits.

Efficiently managed traction properties have continued to be a source of profit to central stations, and it should, moreover, be remembered that all the advantages so gained are not readily estimable in dollars and cents. In this respect one must consider the betterment of load factors and the continual adding of new light and power customers to central stations brought about by the more intensive populating of urban residential sites and the development of suburban areas, as a direct result of street car facilities.

Before leaving this subject it might be well to conclude by remarking that the growth in use of electrical energy has not occurred without meeting severe competition from other sources. The consumption of fuel oil and coal gas for heating and industrial processes has especially reached tremendous proportions, the use of the former having been early encouraged by low prices in effect during the years of petroleum over-production in 1923 and 1924. The growth in consumption of coal gas, not for lighting purposes, but for cooking, heating and industrial processes, which to-day consumes about 90 per cent of the total output, has been an outstanding feature of this period. Such a tendency was noticed by electric light and power companies some years ago, and the past decade has been remarkable for the number of independent gas properties, wherever these existed, merged and consolidated with existing electric light and power properties. The result has been that, in most cases, whatever increased revenue has been gained from gas consumption has largely accrued to the benefit of established public utility enterprises.

Administration and Financial Development

The vast developments and extensions that have occurred in that period under review, as emphasized in the preceding sections, must lead one to conclude that problems confronting public utilities have not been solely technical in character but have necessarily included administrative and financial problems as well. An industry cannot show a ten years' increase in gross revenue from $882,750,000, as in 1920, to close to $2,000,000,000 in 1929, and a growth in capital investment from $4,100,000,000 to $9,700,000,000 within the same period without having necessitated a considerable number of changes, both corporate and financial.

Such has indeed been the case, and in the search for economic methods of operation probably the most important feature was the early manifestation of a definite and well-marked tendency toward financial consolidation. This factor has, moreover, arisen as a natural outcome of the long-recognized principle that local monopoly is the only basis on which a public utility can economically operate. As engineering achievements during the first three or four years of the decade made the scope of operations of the central station an ever wider one, it became necessary in following the above policy to consolidate or amalgamate, as the case might be, a number of hitherto independent operating companies.

It may be presupposed that such practices were not exempt from the ever-present political opposition. It is rather interesting to note, however, that after 1925 this antagonism largely disappeared as a result of the enlightenment of public utility commissions, but probably more so because of a specific decision rendered on this point. In January, 1925, Justice Cook of the Supreme Court of Tennessee held that the statutes of Tennessee authorized the Tennessee Electric Power Commission to retain a certain monopoly in the distribution of power in that state. It was specifically stated that anti-trust laws forbidding combination in restraint of trade could not apply to the control of electric power considered as an energy or force in nature.

Whether due or not to such authoritative decision, since referred to in a number of similar cases, it is undeniable that mergers and consolidations in the public utility field have been singularly free from the legal and political entanglements so characteristic of American railroad and industrial history.

The past decade, moreover, if not giving birth to, has at least caused a great impetus to be given to, the formation of so-called "holding companies." The latter has indeed been a much misunderstood term, owing largely to a lack of appreciation of their function as bankers, in many ways, to the electric light and power industry. These holding companies showed tremendous expansion during the years 1920-1925, a period which was remarkable for the number of independent operating companies which passed to their control. The growth to tremendous size of such holding or investment companies as the American Gas & Electric, the Columbia Gas & Electric, the United Light & Power and many others, although founded many years ago, can be accepted largely as a feature of the past ten years.

It would be a refusal to face actual problems were one not to admit that such "delocalizing" of the industry, especially as of recent years, having caused the electric light and power corporation to resemble the railroad in capital and executive structure, has produced grounds of discontent on the part of certain communities. These maintain, among other things, that the investment company has enriched itself at the expense of the public by gains arising from swollen market values, from underwriting and trading profits, or from the collection of excessive dividends from operating companies. It is, moreover, felt that better relations could be had with the public if the control and management of the local utility rested entirely within the com-

munity served. Whatever viewpoint be taken, there is undeniable proof, however, that the holding company has been a decidedly constructive factor in the development of the industry. It has continued to facilitate the provision of excellent service to increasingly large numbers of small towns and communities—a service unobtainable in any other way—while investments by bankers in certain enterprises would never have materialized but for the holding companies back of them.

FINANCIAL REQUIREMENTS

Before leaving this topic it may be well to point out that the tendencies noted above were largely responsible for the great activity in public utility stocks during 1923 to 1925. This movement attracted considerable attention at the time owing to the huge rise in values that occurred. The purchase of public utility shares in the open market by financial interests resulted in quotations being finally determined more in accordance with the book value of the various stocks in view of merger plans than by actual yield return from dividends.

Since 1925, however, a number of such issues have necessarily disappeared as consolidations have materialized, while numerous others, speculative in nature and overinflated in value, have suffered a natural decline. It is only just to say that where mergers were carried out on a sound basis under reputable management, and where securities have been sponsored by well-established investment houses, anxious to guard not only their own reputation but that as well of the industry in general, excesses in market values were early prevented. Investors in sound public utility corporations have not suffered losses from such deflation.

The capital requirements of the industry have been large. During the war years public utilities were held in bad repute, with the result that necessary means for expansion were lacking. Nothing more remarkable has perhaps occurred in the development of the industry during the past decade than the almost overnight change in the general estimation of the value of a public utility investment. It was indeed a happy feature that, just at the time when the industry was in crying need of money, banks and financial institutions suddenly realized that the electric light and power company had emerged from the great deflation period of 1921 with an enviable record for stability and earning power. The record of failures in 1921 included 495 manufacturing enterprises with liabilities of $233,000,000, forty-five national banks with liabilities of $28,000,000, fifteen savings banks having liabilities of $4,500,000 and only nine electric light and power companies with total obligations of $302,000.

The great expansion in domestic public utility financing occurring soon after followed as a consequence. Whereas in 1920 new securities amounting to $326,374,740 were sold, this figure grew to $589,960,660 in 1922 and to $1,250,000,000 in 1925, these sums being exclusive of local sales by companies to customers and employees. While it will be noted that the amount of annual financing trebled in the first five years of the decade, more recent sales have presented a much smaller rate of growth. It was necessary after 1924 to raise an average of about $1,000,000,000 annually to satisfy the constantly growing demands for efficient service, but there has appeared a tendency for the amount of new financing to decrease slightly in more recent times. In 1929, for instance, proceeds from security sales to the public and from customer-ownership campaigns netted about $700,000,000 as against $1,200,000,000 so raised in 1924, five years ago.

Of importance, moreover, are the various uses to which these immense annual sums have been put. Without entering into great detail on this interesting topic, it is sufficient to state that in the early part of the decade, the very youth of the industry required about 90 per cent of the money so raised to be used for extensions and new developments in the field. More recently, however, increased proportions have been set aside for refunding purposes. As early as 1924 no less than $223,000,000 was so used, and companies have continued to profit from their enhanced credit standing and the protracted low interest rates on capital to refund obligations issued under closed mortgages during 1920-1923, when money was comparatively dear. Not only were general interest rates high at that time but the majority of public utility bonds which were issued then required the inducement of a particularly high interest return as befitted their ranking as lower grade investments.

A word should be said of the various methods of financing devised. These have indeed been many and varied during the period under review. Early financing by the issue of ordinary first mortgage bonds were necessarily limited by the restrictions inherent in such obligations. There was soon devised, however, the "open-end" first mortgage by which first mortgage bonds could be issued under the same indenture at various times with full advantage being taken of a drop in interest rates. Without entering into details it would be sufficient to say that the "open end" mortgage has materially curtailed the expenses of financing by the fact that all issues have been sold as "first mortgages" without the necessity of refunding at call prices obligations previously emitted; as such they have commanded higher prices than had they been disposed of as "second or general mortgage bonds."

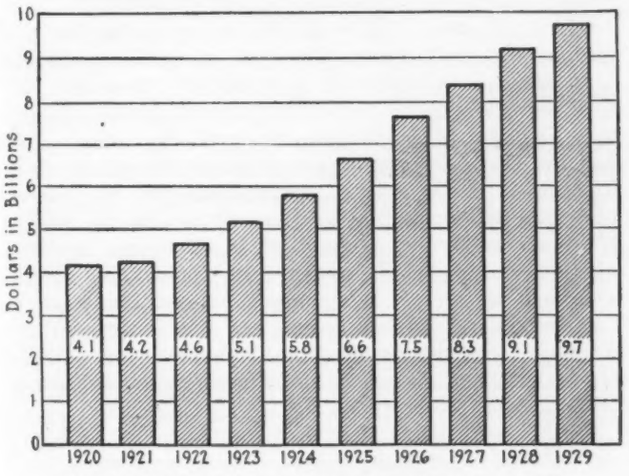
A great deal of later financing was carried on through the sale of preferred stocks, in many cases to customers and employees. This has been frequent where holding companies, retaining the common shares of operating companies under their control, have sold preferred stock of the latter to the public. An important objection to this method has been found in that it has had the tendency to undo the efforts carried on toward customer ownership of local utilities. Real ownership, with voting powers and participation in rising profits, comprised by the term, rests in most going concerns with the common stock holder and not with the holder of preferred.

A further development of more recent date is seen in the extensive financing by debentures, especially in the case, again, of holding companies. Here the financial structure has become really complicated and has necessitated an elaborate study of conditions before purchase was justified. These debentures have not been secured by specific mortgages but have depended largely on the earning power of the issuing company and its subsidiaries, some having the further security of collateral stocks held in trust. The debentures of large corporations issued by reliable banking houses have undoubtedly proved to be profitable investments of the first rank. Yet the greater skill generally required when dealing with this more complicated method has

quite frequently prevented a proper amount of attention being given by the ordinary investor to the intrinsic worth of various issues in this class. In some cases, for example, obligations ranking ahead of the issues have been numerous, while the earnings of operating companies have not been available every year in full to the holding company.

Finally, in the case of long-established public utilities of good standing, the selling of common stock has been successfully carried on throughout the whole period, especially where it has been desired to make customers co-sharers in the success of the industry.

The past five years have been especially characterized by the continued lowering of yield on good public utility investments. This tendency has been given added impetus as various states have in turn rendered these legal securities for savings banks and other institutions, where such was not the case earlier in the decade. The continued increase in gross earnings has facilitated the inauguration of dividends on a number of common



CAPITAL INVESTED IN ELECTRIC LIGHT AND POWER INDUSTRY, 1920-1930

stocks hitherto bearing no return. It should, however, be stated that as the industry now serves by far the greatest proportion of its potential customers, earnings of individual companies will henceforward reflect the vagaries of the business cycle to a greater extent than they have ever done in the past.

In concluding, one might do well to make mention of an interesting development which, if not bearing directly on the financial problems of the public utility enterprise, may at least be construed as having an intimate connection with it.

Such is the growth of the "investment trust" as an adjunct of the industry. These enterprises, a long time ago, had become popular in Europe for all branches of commerce, but for some reason or other were never able to find favor with the American investor. However, the unprecedented demand for public utility investments, some four or five years ago, caused the formation of investment trusts, with electric light and power stocks as the collateral securities, to be an instantaneous success. They appear today under various names, such as, for example, the American Superpower Corporation, Electric Investors, Incorporated, the United American Electric Securities, and others. The success of these enterprises and the indication to the public of the possibilities that lie in purchase of good investment trust securities can in many ways be attributed to the growth of the electric light and power industry over the past decade.

There has been presented a brief review of developments affecting the electric light and power industry in all its phases. It must be finally admitted that such stupendous expansion noted to have occurred would have been impossible but for a change in the public appreciation of services rendered by the utilities. As customers have come to appreciate the principles underlying the centralization of power supply with a view to cheaper energy and better service, public confidence has increased.

PUBLIC RELATIONS AND NATIONAL PROBLEMS ARISING FROM ELECTRIC LIGHT AND POWER DEVELOPMENTS IN THE PAST TEN YEARS

Agitation for government ownership, once quite menacing, has very largely disappeared. People have come to realize that utilities have now largely become public property through the simple method of stock purchases by thousands of customers and employees. In fact, customer ownership has been an extremely important factor in the successful growth of the electric light and power company, for not only has it enlisted the services and good will of the various communities served, but has, moreover, constituted valuable equities behind the bond investments of bankers and financial institutions—the early sponsors of the industry. A reassuring sign for the future has been the creation of a special "public relations" department by utility corporations, as was done some five years ago by the Public Service Corporation of Northern Illinois.

The question of equitable rates has always been to the forefront among the problems of public utility administration. During the first few years of the decade, however, the generosity of corporations in continuing to lower the price to consumers in the face of higher commodity prices had the effect of disarming the customary critic of exorbitant charges. In the past two or three years, however, rate decreases have been much less frequent, because the industry has come to realize that, under a more normal basis of operation, it would be inadvisable to lower the margin of profits to such an extent as to be seriously handicapped by an unforeseen contingency. Permission to lower rates is always readily granted, but the turbulent history of electric transactions indicates, if anything, that sanction to increase rates is quite a different matter, even when economically justified.

Political attacks against electric light and power enterprises have, as a result, been somewhat revived of late. The contention does not bear directly against rates so much as against the supposedly high earning power allowed companies by enactment. These are permitted to earn 8 per cent on property valuation as compared with 6 for railroads, and it has been sought, in certain quarters, to enforce more stringent recapture clauses in the case of the former. However, it should be remembered that public utilities have their own special problems and certainly have definite obligations toward hundreds of thousands of customer-owners —a fact which must be lent serious consideration. Although a possible change in viewpoint on this question would constitute a serious menace to the industry, the attitude of the highest courts on this matter should be construed to mean that the present valuation practice is both sound and just.

As the distribution of electric power over intercon-

nected lines has come to cover an ever-widening expanse of territory, it is natural that demands should have been made for federal control of transmission lines, either by the Interstate Commerce Commission or by a special body created for that purpose. Like railroad transportation, transmission of energy has become so vast in scope as to be a matter of concern to more than any one state, and the creation of a federal commission having regulatory powers, like those possessed by smaller state bodies, has followed as a necessary consequence of "super-power." Such a move, far from being a danger, should, on the contrary, prove to be a constructive development. An important federal body of that nature can better afford to include among its personnel men who are experts in public utility problems and are, moreover, less inclined to be moved by the petty politics sometimes prevalent in state bodies.

An important feature of the past ten years is the tremendous industrial expansion that has taken place in the South, due in large measure to the efficient production of electrical energy. The combination of cheap labor, abundant raw material, and low-cost power have caused commercial and financial interests to realize, to a greater extent than ever in the past, the vast possibilities that lie in such states as Georgia, Tennessee, Virginia, the Carolinas, and to a certain extent, in Texas. The South has become a rival of New England in commercial importance, and herein is found an important problem of which brief mention should be made.

The huge super-transmission system, covering the northeast section of the United States, has gone a long way toward supplying economically the great power requirements of New England, but such has not been deemed sufficient. In the light of these facts, there has been, during the past five years, a growing demand for importation on a huge scale of electrical energy from Canada. The problem thus presented has both its political and economic aspect. Although such a move would undoubtedly prove to be a huge benefit to the New England States, leading Canadian interests are stanchly opposed to any great developments along these lines. In 1925 a tax was levied on electrical energy exported from the Dominion, the Hon. J. A. Robb, then acting Minister of Finance, explicitly stating that the government had a double object to serve, viz.: To secure revenue and to discourage the export of power.

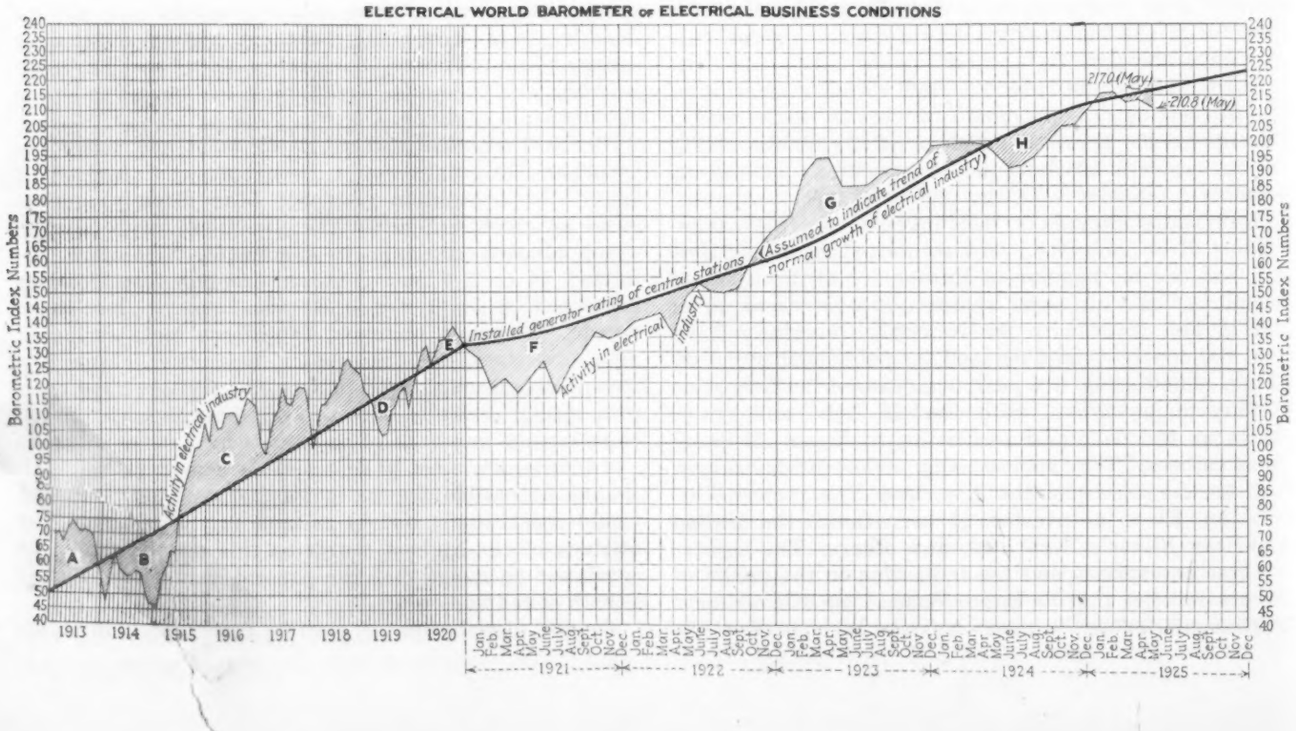
Of late, however, there has been a growing body of opinion, especially in the Province of Quebec, whereby it is firmly contended that a prosperous New England is of infinitely more benefit to eastern Canada than a New England of declining commercial importance, and that the Dominion should not willingly constitute itself an obstacle in the way of maintaining the highest industrial activity in that section of the United States. Whatever viewpoint is held, it is, however, doubtful whether the export of power from Canada on a huge scale will be an accomplishment for yet many years. The controversy, grown recently to sizable proportions, promises to become as important a factor in the political life of both nations as the once important questions of boundaries and reciprocity.

While many years must necessarily elapse before it will be possible for an observer, reviewing these past ten years, to judge of the changes brought about by the vast developments in the industry, certain tendencies appear sufficiently evident as to warrant at least one definite conclusion at the moment. In a word, the existence of excellent power services in all important

May Operations Under Those of April

PRODUCTION figures upon which the "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" is based indicate that May witnessed a further decrease in the activity of the industry. A large number of the primary industries which are considered as indicative of general industrial activity were operating several per cent below the estimated normal during May, and this recession is reflected in the activities in both the electrical industry as a whole and the central-station branch of the industry.

During May the electrical industry as a whole was operating at 6.2 per cent below the estimated normal for the month. In April it was operating at 2.9 per cent (revised) below normal.



sections of the country, has been the final step in the economic transformation of the rural community. First the railroad, then the automobile and now the advent of cheap electrical power. As a result, life on the farm today offers all the special facilities possessed earlier in the decade only by the urban electrified home. By the development therefore of super-transmission, by the provision of an efficient and economical electrical service to country districts, leading interests in the light and power industry can feel that they have accomplished something of national significance, and their contribution to the prevention of rural depopulation—a problem that has always been of immense importance in the economic life of the United States—can well stand as a monument to their work.

Letters from Our Readers

Difficulty in Obtaining Industrial Electric Heating Data

To the Editor of the ELECTRICAL WORLD:

I have read the editorial "Better Industrial Heating Data Are Needed" in the May 9 issue of the ELECTRICAL WORLD and agree that there is a decided lack of good data showing the relative costs of carrying on process heating by electricity and the different fuels. Considerable progress has been made in this direction during the few years that electric heat has been used on a broad commercial scale, but, as stated, such data are as yet wholly inadequate.

It should be pointed out, however, that the lack of data is not the result of indifference on the part of those interested in the advancement of electric heating, but is rather due to the serious difficulties involved in obtaining reliable data, which can be secured only after years of careful study. Some of the difficulties of obtaining "before and after" data are:

1. In the majority of cases where an electric furnace replaces a fuel-fired furnace the latter is of an obsolete design and the over-all cost of operation is higher than would be the case with a modern fuel-fired furnace. Much information showing comparisons between the obsolete fuel-fired furnace and the new electric furnace has been obtained, and some of it has been published. In general this has been a disadvantage to the electric furnace, since it can be readily proved by the advocates of the fuel-fired equipment that the comparison is not fair. On account of the difficulty of finding two identical heating installations, one where the modern fuel-fired equipment is used and the other where electric heating equipment is used, it is exceedingly difficult to make accurate comparisons.

2. In the great majority of industrial heating applications the cost of fuel or electricity plays a very minor part in the over-all cost of the finished product, while the heat treatment may play a very important part in the quality of the product. Any comparison of costs which concerns itself with the relative cost of electricity and fuel is, for that reason, often misleading.

3. In addition to the effect on the quality of the product, the type of fuel used may also in many cases largely affect the cost of subsequent operations such as cleaning and machining. The superior atmospheric conditions in one type of furnace do in some cases result in a greater saving in cleaning cost than the total cost of heat treatment. Moreover, the better heat distribution and control with one form of fuel may produce a product of such uniform hardness that the subsequent machining operations will be greatly reduced in cost.

4. Atmospheric conditions, affecting the morale and health of the employees, may in many cases outweigh such considerations as the relative cost of fuels. The better atmospheric conditions surrounding one type of furnace may make it possible to install that furnace in the line of production in the machine shop, whereas with another furnace, with objectionable atmospheric conditions, it may be necessary to install the furnace in a separate room. In the second case the cost of transporting the articles to this room must be included.

5. No cost data are complete without a comparison of maintenance as well as an estimate of the loss in production due to furnace shutdowns. Data of this kind can be acquired only after long operation.

There are many other reasons why relative cost data are incomplete and why advocates of electric heating are loath to publish any data which do not take into consideration all of the many factors which I have enumerated. A comparison involving only the cost of fuel and electricity is usually detrimental to electric heat and in many cases represents only a very minor consideration in over-all cost.

C. L. IPSEN,
Engineer Industrial Heating Department.
General Electric Company,
Schenectady, N. Y.

Automatic Control of Waterworks Pumps

To the Editor of the ELECTRICAL WORLD:

I wish to call attention to the fact that in the article by the undersigned entitled "Complete Automatic Control of Pumps in Waterworks Plant," on page 978 of the May 9 issue of the ELECTRICAL WORLD, the customer of the Pacific Gas & Electric Company mentioned was the Stockton Waterworks, which is owned and operated by the Pacific Gas & Electric Company. The engineering work on the control system described was done by myself and the installation was made by the Pacific Gas & Electric Company.

H. S. LANE.
San Francisco, Cal.

On Most Economic Power-Factor Formula

To the Editor of the ELECTRICAL WORLD:

Referring to my letter in the May 9 issue, containing a general expression of the most economical power factor, I wish to correct a few typographical errors and add a few points of importance.

1. The term l should be defined as being equal to the condenser losses (100 per cent minus efficiency), plus all losses connected with the operation of the power-factor corrective equipment, expressed decimally as a percentage in terms of the condenser rating.

2. P = kilowatts delivered at receiving end.

3. When cos θ_e is less than the given power factor, cos θ_g, there will result an annual loss in an investment; when cos θ_e = cos θ_g, nothing would be gained, and finally when cos θ_e is greater than cos θ_g, then, under the conditions given, cos θ_e is the most economical power factor, from the standpoint of I^2R losses.

4. The formula

$$\tan \theta_e = \frac{E^2(I_s p + Vl)}{2\,PV\,10^3\,Mr}$$

where $V = 8760\ T_L k$, is also applicable to high-tension long-distance lines, within the limits of accuracy inherent to concentrated capacity methods.

GEORGE F. MARSTELLER.
Boston, Mass.

Central Station and Industrial Practice

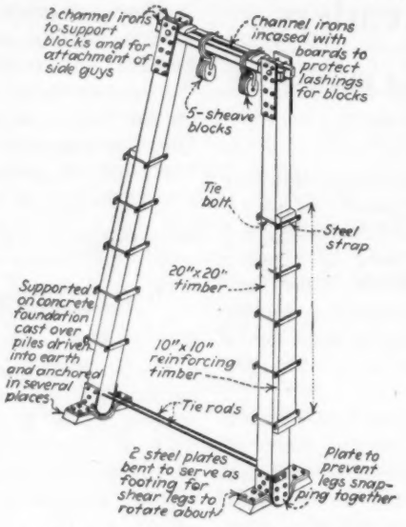
Handling Facilities for Heavy Equipment

ALTHOUGH a 50,000-kw. turbine is not received from England every day, the occasion for providing special temporary facilities for loading or unloading heavy parts may arise most anywhere. Hence the method of unloading the 1,000-ton turbo-generator, recently received by all-water route from England, by the Commonwealth Edison Company may have more than spectacular interest. The equipment was received in 187 pieces, two of which weighed 78 tons and 67 gross tons respectively. One of these pieces measured 19x17x18 ft. over all. Thirteen other pieces ranged in weight from 20 to 50 tons each.

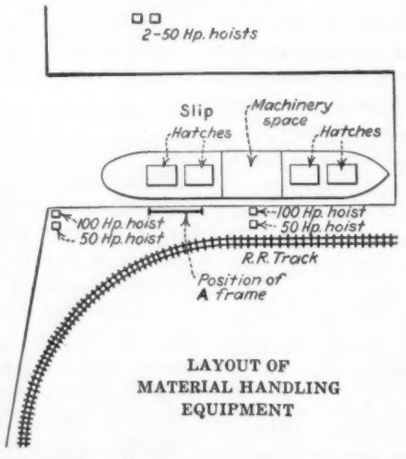
Since the vessel carrying these parts had to be unloaded at a point where permanent heavy-duty unloading equipment was unavailable, special unloading facilities had to be made and installed. The chief problem was to design and support an A-frame that would safely unload the heaviest piece—namely, 78 gross tons—and also permit swinging between its supports the piece having the maximum dimension—namely, 19 x17x18 ft. In general, this was constructed of stiffened one-piece timber struts with a crosspiece at the top consisting of two channel irons.

As can be seen in the accompanying illustration, the struts consisted of 20x20-in. timbers stiffened at the middle by 10x20-in. timbers clamped thereto by means of steel straps and tie bolts at frequent intervals. The struts themselves were likewise clamped at intervals. The channel irons forming the crosspiece rested on the top of the struts and were held in place by steel plates bolted to the top of the struts and by bolts running through these plates and the channel irons, which were separated by spacing blocks. Around the channel irons were fastened heavy planks to protect the lashings supporting the blocks used in supporting the heavy equipment handled. Two five-sheave blocks, supported as indicated, were used. Between the bottom of the struts were two tie rods to prevent their spreading.

Owing to the heavy weights lifted and the fact that the temporary crane had to be supported near the water's edge, special foundations had to be prepared. These were formed by driving piles and casting over their head concrete foundations, in which were molded two formed steel plates to serve as pivot points for the crane legs. To prevent horizontal displacement, the foundation had to be anchored in several directions.


2 channel irons to support blocks and for attachment of side guys
Channel irons incased with boards to protect lashings for blocks
5-sheave blocks
Tie bolt
Steel strap
20"x 20" timber
Supported on concrete foundation cast over piles driven into earth and anchored in several places
10"x 10" reinforcing timber
Tie rods
2 steel plates bent to serve as footing for shear legs to rotate about
Plate to prevent legs snapping together

A-FRAME USED FOR HANDLING VERY HEAVY MATERIAL



LAYOUT OF MATERIAL HANDLING EQUIPMENT

The ends of the crane legs were cut off to give a semi-cylindrical surface instead of a flat surface, and were covered with steel plates rolled to conform with this surface and bolted to the end of the legs. Steel plates of the shape indicated in the illustration were also fastened to the lower ends of the crane legs on the two outer sides to prevent the legs springing together when the load was suddenly removed.

Side guys were fastened to each end of the channel irons forming the cross-bar of the crane and head guys attached thereto were run to winch houses on each side of the crane in the direction of motion. Winches for operating the hoisting tackle were installed on each side of the crane, but at right angles to the direction of motion.

Since the equipment to be handled by this crane was of considerable value and could not be replaced in many months' time if injured in handling, the improvised crane was tested for safety before handling any of the equipment. This was done by loading a gondola car with rock to give a load equivalent to twice that of the heaviest piece to be handled, and going through the motions of hoisting and moving this test load to ascertain if any signs of weaknesses were manifested. The crane withstood this test and all of the equipment was unloaded expeditiously with no mishap.

It might be pointed out that owing to the dimensions of some of the pieces, and the railroad clearances available between the unloading point and the destination of the equipment, provision had to be made for transporting the larger pieces from the unloading point to the destination over four railroads on a Sunday when physical clearances could be secured, taking the equipment over a roundabout route, although the destination was not far from the unloading point.

Value of Zinc Treatment of Wood

THE value of treating wood exposed to weather with zinc chloride or zinc chloride and petroleum, so far as decomposition is concerned, is indicated by the findings of the Santa Fé System.

During the years 1915, 1917 and 1920 the Santa Fé System laid nearly a thousand ties of various woods treated with zinc chloride alone, or in a mixture with Bakersfield (Cal.) petroleum, in a special test track on the Beaumont division, Texas. All but three of these experimental ties were in track at the official inspection in December, 1923.

Six hundred and seventy-six ties

RESULTS OF SOME SPECIAL TREATED TIE TESTS ON BEAUMONT DIVISION, SANTA FE SYSTEM

Zinc Chloride

Kind of wood	Absorption per Cu.Ft. Zinc Chloride Lb.	Absorption per Cu.Ft. Petroleum Lb.	Year Inserted	No. Inserted	Still in Track Dec., 1923	Life of Ties of Dec., 1923
Pine, sawed	0.503	....	1915	132	129	7.88
Gum, sawed	0.848	....	1915	26	26	8.00
Pine, hewn	0.757	....	1917	20	20	6.00
Pine, sawed	0.526	....	1917	40	40	6.00
Oak, hewn	0.297	....	1917	20	20	6.00
Gum, hewn	0.630	....	1917	20	20	6.00
Gum, red, sawed	0.343	....	1917	100	100	6.00
Gum, black, sawed	0.579	....	1917	100	100	6.00
Beech, sawed	0.409	....	1917	99	99	6.00
Magnolia, sawed	0.600	....	1917	69	69	6.00
Pine, hewn	0.500	....	1920	50	50	3.00
Total	....	....	....	676	673	....

Zinc Chloride and Petroleum

Kind of wood	Absorption per Cu.Ft. Zinc Chloride Lb.	Absorption per Cu.Ft. Petroleum Lb.	Year Inserted	No. Inserted	Still in Track Dec., 1923	Life of Ties of Dec., 1923
Pine, sawed	0.503	12.07	1915	49	49	8.00
Pine, hewn	0.568	10.66	1915	32	32	8.00
Pine, sawed	0.270	0.09	1915	10	10	8.00
Oak, hewn	0.465	4.02	1915	28	28	8.00
Oak, sawed	0.457	3.43	1915	11	11	8.00
Gum, hewn	0.486	5.54	1915	6	6	8.00
Gum, sawed	0.486	6.45	1915	49	49	8.00
Elm, hewn	0.587	2.63	1915	10	10	8.00
Pine, hewn	0.829	2.87	1917	20	20	6.00
Pine, sawed	0.520	1.95	1917	40	40	6.00
Oak, hewn	0.310	2.23	1917	20	20	6.00
Gum, hewn	0.802	3.02	1917	20	20	6.00
Total	....	....	....	295	295	....

treated with zinc chloride were impregnated with from 0.297 to 0.757 lb. of zinc chloride per cubic foot, while 295 ties treated with zinc chloride and petroleum contained from 0.09 to 12.07 lb. of the mixture per cubic foot. The woods treated included pine, 393; gum, 321; beech, 99; oak, 79; magnolia, 69; elm, 10. Of these ties, 725, or about 75 per cent, were sawed, and the remaining 246 were hewn.

The effect of such treatment in retarding burning of the wood or on the electrical conductivity, which would also be of interest in connection with pole lines, is not indicated by these tests.

Aids to Continuity of Service, Safety and Economy of Operation

CONTINUITY of service, safety of operators and maintenance men, and economy of operation should be the guiding considerations in designing, installing and operating switching and control apparatus, declared G. G. Post, electrical engineer Milwaukee Electric Railway & Light Company, recently. The two things that contribute chiefly to continuity of service are selection of the proper types of apparatus and proper installation of the apparatus. When both of these factors have been carefully considered, there may still be failures due to hidden defects or errors in operation, but in a well-designed station the damage resulting therefrom should be relatively small. The competent designer will keep continually in mind the fact that trouble may occur and will lay out his apparatus in such a way as to keep the trouble from involving other apparatus. An example of this principle is found in the segregation of the phases which has been adopted in many modern stations.

Isolating Phases

Troubles may also be limited through the judicious use of suitable barriers, doors and compartments, and by covering bare copper with suitable insulation, especially in stations where the capacity is great and the voltage moderately high—say 11,000 volts or over. Covering of bare copper to prevent volatilization in the presence of an arc is desirable, as the gases that occur may cause arcs to strike to other live bare parts.

In acquiring small properties, large companies are usually confronted with the necessity of replacing at least some of the oil circuit breakers to obtain ample rupturing capacity. All systems, no matter how small, will some day be tied in with larger systems and the use by them of breakers with higher rupturing capacity than immediately necessary may therefore be justified.

Current or series transformers frequently cause trouble due to excessive mechanical stresses under severe overloads or line failures. Hence on large systems or on systems connected to large ones, one-turn current transformers should be used wherever possible.

Control switches should be conveniently and systematically arranged or paneled and plainly labeled or tagged to enable the operator to perform a given operation, such as cutting in or out of a generator, with the least effort. The more an operator has to move around in performing a given operation, the more likelihood there is of mistakes, particularly if speed is required. Experience has shown that the benchboard form of operating board is superior for generator control, because of the numerous control switches, signals and so forth which must be operated in cutting in a unit.

Bus Protection

The installation of a disconnecting switch immediately above an oil circuit breaker without a barrier between them is not the best practice, because if the breaker fails, the disconnect is almost sure to be damaged. If it is connected to the bus and the insulator on the bus side is damaged the bus may be kept out of service until the disconnect can be cut off. Disconnecting switches, therefore, should be protected from arcs or fires occurring in oil circuit breakers. Some designers go to the expense of providing two sets of busbars and then throw away a part of the advantage by installing selector disconnects in the same compartment. If there is trouble on one, both are likely to be involved and both sets of busbars may be put out of service.

It is important to have all disconnecting switches provided with safety catches to prevent them from being opened by the magnetic fields set up during serious short circuits or system trouble. Furthermore, all disconnecting switches in series with oil circuit breakers should probably be interlocked therewith so they cannot be opened or made accessible while the breakers are closed. During recent years factory-built safety truck-type switching equipment has been developed and installed in a number of stations, particularly in large cities. The construction is safe, without question, but its cost justification will have to take into consideration labor conditions.

In substations, particularly, a big step has been taken in economical operation through the use of automatic switchboards. In one large city the utility has decided not only

to equip all new substations with automatic switchboards but to change over all existing manually operated stations. Where direct-current networks exist without storage-battery reserve, automatic substations are particularly advantageous in that if a "kickout" occurs the load can be picked up more quickly than by non-automatic stations. This is due to the immediate functioning of the apparatus, elimination of confusion of operators under trying circumstances, and the fact that if equipment is fit to go back in service it will be restored to service. Here again, however, the question of service as well as economy must be given consideration in determining whether a station should be automatic or manual.

If a comparison should be made of the measuring instruments used on power plant and substation switchboards in various cities, a great diversity of practice would be found. Engineers of the utilities in four large cities recently made a study of the situation and decided that there was little occasion for such difference in practice.

It is reasonable to say that the switchboard designed to give reasonable service is also a safe one.

Electric Furnace Produces Quality Steel

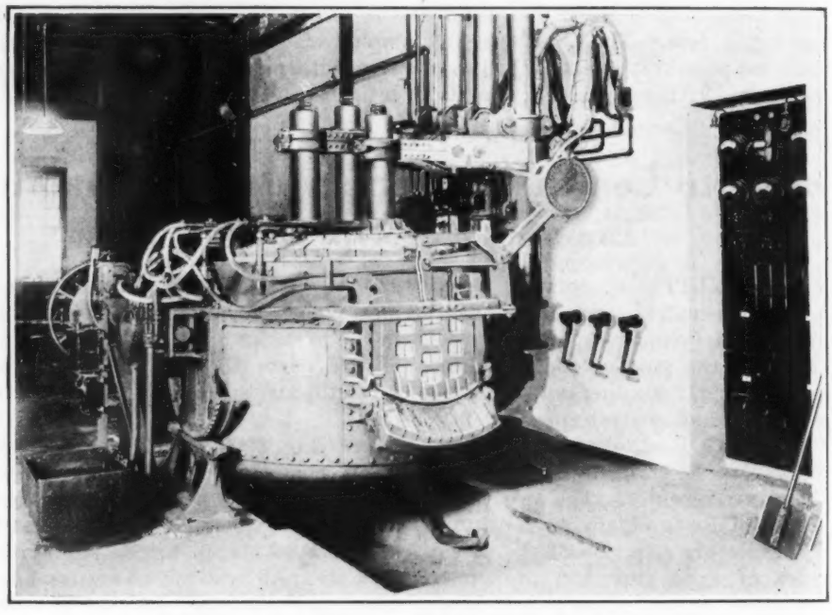
Assures High-Grade Automobile Valve Heads and Proper Control of Supply —Annual Saving $17,000

BY C. N. DAWE
Metallurgical Engineer Studebaker Corporation, Detroit, Mich.

IT IS important in the manufacture of high-grade automobiles that the material and processes be under the control of the manufacturer as much as possible. With this in view the Studebaker Corporation, Detroit, installed the equipment necessary for making a large part of its own valves in the latter part of 1922. Thus were obtained both an assured supply of valves to meet any production schedule and materials and workmanship in the valves that measured up to the Studebaker standards. An important part of this installation is the Moore "'Lectromelt" furnace, made by the Pittsburgh Electric Furnace Corporation. This furnace was selected after various other types and makes were carefully considered.

This furnace uses the acid process and has a rated capacity of one ton per hour. It is run only at night and on a reduced demand in order to even up the electric load. At present the furnace is not operated at full capacity, only four heats being run in twelve hours. Charging is done by hand, the maximum charge being 2,600 lb. and the average approximately 2,230 lb.

Each heat requires approximately twenty minutes for hand charging, 100 minutes for melting and thirty minutes for pouring. The melting is started at high voltage tap—that is, with a long arc—which is maintained for about half an hour, after which the furnace is switched to the low tap. The furnace operator spends his entire time on the furnace and has one helper, about 60 per cent of whose time is spent on the furnace. For pouring, the furnace can be tilted either by hand or motor power.



ONE-TON FURNACE USED BY STUDEBAKER CORPORATION

The charge consists almost entirely of scrap material. During a typical month, the following materials were used: 22.32 tons of scrap from gates, wells and sprues from the molds; 29.72 tons cast iron borings; 13.48 tons foreign scrap cast iron; 1.16 tons pig iron; 0.8 ton ferrosilicon; 0.46 ton ferrophosphorus; 9.9 tons tar and petroleum products.

Regular analysis of the cast iron is made to insure highest quality possible. A typical analysis shows 3.4 per cent carbon; 0.42 per cent manganese; 0.15 per cent phosphorus; 0.12 per cent sulphur and 2.7 per cent silicon.

Carbon electrodes have been used until recently, but graphite is now being tried to determine whether it is more economical. The pouring door has been replaced so that only a tap hole is used. It is plugged with sand and a piece of an old electrode which can be pulled out easily when ready to pour. No trouble is experienced in working the bath from the charging door only. A large one-piece brick is used on the bottom of the charging door so that when replacement due to wear is necessary, only this brick need be removed, the upper brick being undisturbed.

The melt is poured at 2,700 deg. F., in order to assure a perfect weld of the heads with the stems in the molds. Due to running on a reduced tonnage schedule of four heats per night, the furnace consumes 780 kw.-hr. per ton of metal produced, using carbon electrodes. Fifteen pounds of electrode carbon and 10 to 20 lb. of 44 per cent silicon ore are consumed per ton of metal.

The roof of silica brick and the side wall lining last an average of 100 tons of output. The roof costs $52 and the side walls cost $60, including labor and material. The life of the silica bottom is indeterminate, but it has been replaced once to date. Mechanical repairs on the mechanism operating the furnace have been negligible.

The cost for power, electrodes, labor and material for refractories and labor for furnace operation is $17.19 per ton produced. The cost will be reduced to a considerable extent when we put the furnace into more continuous operation to supply metal for other parts.

COST OF OPERATING ONE-TON PITTSBURGH ELECTRIC FURNACE

Carbon electrodes, 15 lb. @ $0.08..	$1.20
Refractory repairs	1.12
Ferro-alloys, 15 lb. @ $0.025.....	.38
Labor	2.79
Power, 780 kw.-hr. @ $0.015.....	11.70
Conversion cost per ton.....	$17.19

APPROXIMATE COSTS AND SAVINGS

Purchase cost per valve unfinished	$0.09
Cost unfinished valve using electric furnace	.07
Saving per valve	$0.02
Saving per year, 850,000 × $0.02.	$17,000.00

Previously, all valves were purchased. Thus the source of supply was not under control and, of course, a profit had to be paid the manufacturer. Due to the economical operation of the electric furnace, at least 2 cents per valve is saved, compared to the former purchase price.

On this basis, about $17,000 is saved per year under average production. Besides this, the supply is entirely controlled and the quality of the valves can be kept rigidly up to standard. The service from the manufacturer has been good and the performance of the furnace has been entirely satisfactory.

Applying Unit Cost Analyses to the Distribution Department

By E. A. Barrows
President Narragansett Electric Lighting Company, Providence, R. I.

DISTRIBUTION systems in many companies represent a larger investment than generating plants, but until recently the possibilities of increasing operating efficiency by comprehensiv weekly analyses of work carried on in such departments have often been overlooked. For the past nine months the Narragansett Electric Lighting Company has been utilizing a weekly report of the division of distribution, shown herewith, which has proved very helpful in studying both costs and volume of work done.

The report is divided into four sections, comprising the four largest departments in the division—viz., meter, street lighting, construction and engineering. Each department makes a weekly report to the office of the superintendent of distribution, covering available details of the work done, together with payroll information to enable costs to be computed. Thus far cost figures have been most thoroughly developed in the meter department, and this line of analysis will gradually be applied to the other departments as the use of the report progresses.

These departments had previously rendered monthly reports, but no attempt had been made to gather and study the detailed information now brought every week to the attention of executive staff meetings and embodied in the report shown. Practically every week additional information has been incorporated in the report as it has developed, and while the report is prepared primarily for executive analysis, discrepancies are almost automatically brought to the attention of the department interested, with the result that more efficient methods are constantly being sought and applied to cut down costs. Thus when we first instituted the report, "Inside A.C. Meter Testing" cost us an average of $0.26 per meter, while at present this work costs $0.22. This decrease has been very gradual, but is the result of various minor economies no doubt effected in part as an outcome of this economy study. The monthly report

WEEKLY REPORT OF DIVISION OF DISTRIBUTION

(*A*) Week Ending April 18, 1925.
(*B*) Comparative Figures, Week Ending March 21, 1925.

Meter Department

Installation:	*A*	*B*
Meters installed	365	348
Meters removed	166	179
Meters read	94	78
Jobs no access*	95	72
Jobs, P. & C.† needed*	6	5
Jobs not connected*	7	2
Jobs, board wrong*	1	2
Jobs, Palmer box wrong*	1	2
Jobs, not ready*	19	18
Addresses verified*	31	59
Addresses wrong*	13	16
Orders, succession	443	314
Orders, duplicate*	11	11
*Note: Items not ready	12.2%	11.6%
†Permit routine.		
Testing:		
A. C. meters (outside)	492	396
A. C. meters (inside), new	224	230
A. C. meters (inside), old	142	177
D. C. meters (inside), old	10	14
D. C. meters (outside)	131	134
D. C. meters (outside), large	0	0
Special (outside)	46	86
Complaint (outside)	23	40
Three-phase (outside)	51	44
Installation:		
Five regular crews	365	361

Time Analysis:	*A*, Hr.	*B*, Hr.
Maintenance, substations	138	169
Maintenance, services	38	110
Maintenance, time-clocks, signs and excess indicators	75	70
Repairs, tools	0	0
Repairs, meters	101	107
Repairs, load-boxes	0	0
Changeover, East Providence	145	179
New construction work	80	0
Changing transformers	21	0
Demand work	167	75
Work in boiler room	8	0
New test board	142	0
Clearing 3-ph. grounds	58	0
Stock:		
New meters opened from stock	144	244
Cartons prepared for sale	144	240
Cost Analysis:		
Without helper	$0.56	$0.58
With helper	.24	.24
With helper	.24	.24
With helper, 75 per cent	1.17	1.22
With helper	0	0
Without helper	.63	.64
Without helper	.63	.64
With helper	1.80	1.61
Cost Analysis:		
With helper	$1.32	$1.42

Street Lighting Department

Incandescent:		
Lamps replaced, burned out	425	309
Lamps replaced, broken	128	79
Globes renewed	7	10
Incandescent Lamp Renewals:		
Burned out and broken	553	388

Arc:		
Globes renewed	10	6
Lamps changed and repaired	9	13
Lamps knocked over	0	0
Cost Analysis:		
Unit cost*	$0.76	$1.10

*Figures on lamp renewals in out-of-town territories were not included in last week's report. These figures are included in this week's report, bringing the unit cost down to a considerably lower figure.

Construction Department

Transformers:	*A*, Kva.	*B*
Lighting, installed	210	51
Lighting, removed	353½	27
Power, installed	43	315
Power, removed	4	150
Services:		
Aerial	139	86
Underground	6	0
Cable Installed:	Ft.	
3/0-3/cond.*	1,290	.....
3/0-3/cond.†	2,034	.....
*Elmwood Transmission Cable.		
†Crucible Steel Company.		

Pole Record:	*A*	*B*
Poles set, commercial	62	12
Poles set, municipal	0	3
Poles renewed	23	18
Poles removed	2	6
Street Lights:		
Incandescent	3	24
Arc	0	0
Pipe Installed:	Ft.	
Pipe installed, 2½ in.	77	0
Pipe installed, 3 in.	38	207
Insulator Testing:		
33 kv. tested	732	0
22 kv. changed	56	0

Engineering Department

Inspection:
150 inspections, 211 locations, obtained necessary line data for estimating.

Installation:
Laying out transformer platform and bus structure, Ciccone Cast Stone Company.
Laying out changes in service and switchboard for additionalload, American Silk Spinning Company.
Layout of transformer vault and primary service, Haronian, Ship and Elbow St. (new building).
Layout of transformer vault and aerial-underground primary service, Providence Lying-In Hospital.
Making sketches and prints showing connections of switches and relays for Brown & Sharpe Company, checking and retagging cables.

Distribution:
Making new maps and records of underground conditions in Fones Alley, City.

Street Lighting:
Laying out street series lighting and commercial extension from Stillwater to town line, North Smithfield.
Preparing list of lights and circuits for proposed changes to 600 cp. in Cranston.
Locating ten new lights in East Providence, and two new lights in West Warwick.

Changeover:
Laying out crib changes in Oaklawn, preparatory to changing voltage.
Laying out crib changes, River View, preparatory to changing voltage.
Changed fifty-five customers in East Providence, and two in Cranston.

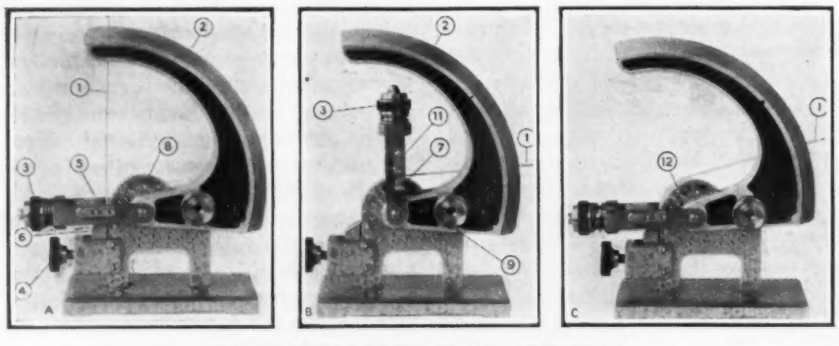
will be extended into a yearly comparison as soon as the report has been issued for that period of time.

Test for Springiness of Magnet Wire

MANY users of magnet wire, particularly those winding armatures and field coils, have found it necessary for the wire to be "dead soft" in order to facilitate winding in the space provided. The term "dead soft" is possibly misleading, because of the fact that the quality desired is freedom from springiness rather than actual softness of the copper. For example, when wire is laid in armature slots, it is desirable to have it remain exactly where placed after the tension is released from each turn. If the wire has a tendency to spring back, the windings will fail to fit snugly into the space designed for them. To overcome such a condition it becomes necessary to pound the winding into position, which is objectionable, as it requires time and also is very likely to injure the insulation and cause rejections of the finished unit.

The difficulty of measuring the softness of any wire, or in reality the springiness, has been a problem to many engineers. The usual method is by elongation tests, but in practical usage these tests are not necessarily a true measure of the springiness of the wire. Recognizing this condition, various other means of testing the springiness of wire have been devised; some are based on the principle of measuring the deflection of test specimens; others are based on the principle of measuring the actual surface hardness of the wire with instruments of standard design for such tests. Engineers of the Allied Magnet Wire Corporation of Indianapolis have approached the problem in a somewhat different manner and have designed and built a testing machine for their own use which operates on the principle of measuring the reaction or springiness by rolling the test specimen over a mandrel through a 90-deg. arc and then measuring the reaction after the pressure of the roller has been released.

A series of tests conducted with this new type of instrument show very consistent results, and it is believed that the data obtained in this manner can be depended upon as a true measure of the springiness of any given size of wire. The test specimens used can be tested either with or without the fabric covering, as no appreciable difference has been noted by the removal of the insulation from any particular sample. The machine also lends itself to very rapid operation, which of course is a big commercial advantage. The Allied Magnet Wire Corporation will supply working blue prints without charge to any manufacturer who desires to duplicate this machine.

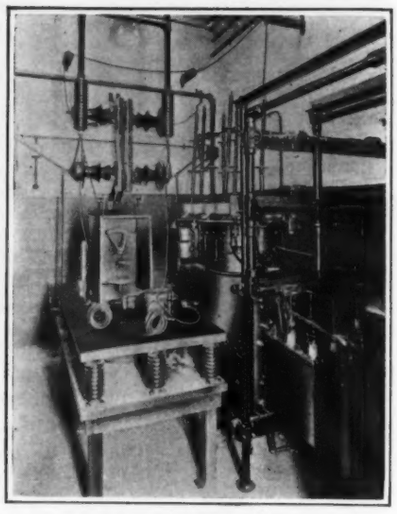


OPERATION OF WIRE-TESTING INSTRUMENT

In *A*, the machine is shown in position for receiving the test specimens of wire (1). The wire is clamped in vertical position by screwing down a thumb screw (4), which depresses a V-block (6) against the lower section of the test specimen. A roller (5) is also depressed against the wire of the plunger (3), which is locked in this position by a bayonet lock. The roller carrier is then moved through an arc of 90 deg. until it reaches a point determined by the registered hole (8). In *B*, the roller carrier is shown after the wire (1) has been rolled over the fixed radius by the roller under spring pressure. The thumb screw (9) is released and the sector (2) is moved to a position where the graduations (10) are adjusted so that the zero point of these graduations is in line with the lower side of the wire (1). The bayonet lock (3) is then released, as is also the latch (11), which lifts the stop pin (7). The roller carrier is then returned to its original position, which releases the tension on the wire test specimen, leaving it free to react in proportion to its inherent springiness. As shown in *C*, the wire (1) takes up a new position, which can be measured on the graduated sector and the degree of springiness is thus determined.

High-Voltage Test Room Designed for Safety

NOTEWORTHY precautions have been taken to make the 100,000-volt test room at the Hawthorne laboratory of the Western Electric Company as nearly safe as human ingenuity can devise. High voltages are needed to run tests on cables, condensers and repeating coils as well as to make breakdown tests.



HIGH-VOLTAGE TEST LABORATORY AT HAWTHORNE

A room with thick, brick walls has been specially designed and built to house the wiring, transformers and test specimen table. Greatest care has been taken to make sure that there is no electrical leakage from the test table to the ground. This test table is in reality two tables. The lower table, which rests on the floor, is of wood. The upper table is supported on porcelain insulators. A slab of slate forms the top, which in turn is further insulated by a Bakelite sheet placed on top of it.

Three switches have been provided. The first of these cuts off the current supply when the primary voltage drops low. The second operates when the load on the transformers becomes too heavy. The third switch, which is of the solenoid type, grounds the apparatus when the test is completed, thus eliminating danger from a high potential stored up in the condensers.

To give greater safety, the switch panels and the induction regulator control wheel have been placed on the outside wall. This arrangement makes it necessary for the operators to step outside of the room before they can send any current through the circuits. They must close the door before they can get any current through the panel; two switches break contact when the door is open.

To start a test, therefore, it is necessary for the men in charge to close the door first and then from the outside of the test room energize the relays that throw the transformer and solenoid switches.

Commercial Activities and Public Relations

Motion Picture Shows Electric Progress in Philadelphia

A MOTION picture delineating the scope and activities of the Philadelphia Electric Company's system has just been completed and will soon be shown to the public. The film, which is entitled "His Spirit Still Lives," is built around the impressions which Benjamin Franklin would experience were it possible for him to return in spirit and see to what lengths his simple experiment with kite and key had progressed. The picture recaptures Franklin's spirit and presents to him the range of interests and activities of the Philadelphia Electric Company in its business of supplying Philadelphia and its surrounding territory.

Largely because of the association of the idea of Franklin's return to earth, this picture has been pronounced a most distinctive, effective and out-of-the-ordinary industrial film. People outside of the electrical industry who have had the opportunity of viewing it have unanimously pronounced it one of the best public utility films so far produced. The picture has been made with a view to showing it before organizations of various kinds, such as fraternal orders, business men's associations, improvement and neighborhood associations. Schools, naturally, will also want it for general and special exhibition.

As a whole, the picture takes about one hour and a half to show. So flexible is it, however, that a presentation of interest and logical sequence can be shown to cover almost any period of time available. The picture, besides its introductory part with historic background, shows the activities and scope of the Philadelphia Electric Company system and displays how electricity is produced and delivered to the consumers' premises, electric service as applied to industry, electric service on the farm and electric service in the home.

The fact that the public schools are emphasizing the importance of public utilities and are imparting knowledge of them in their civics course for boys and girls is indicative of the general tendency on the part of the public to become more intimately acquainted with these utilities, which are such a part and parcel of everyday community life.

The Philadelphia Electric Company plans to give showings of "His Spirit Still Lives" before any organizations desiring it, and, if necessary, will furnish the necessary equipment and operator free of all charge.

National Industrial Lighting Activity

Organization of Direct Selling Campaign to Raise the Standards of Factory Illumination—Methods of Local Participation—$5,000 in Prizes Offered

BY J. F. BECKER
Chairman Industrial Lighting Committee, National Electric Light Association

STATISTICS show that there are thirty million factory lamp sockets, of which not more than five million are equipped with proper reflectors. This indicates a tremendous market for the selling of proper industrial lighting equipment. To meet this opportunity the industrial lighting committee has been formed in the Commercial Section of the National Electric Light Association to conduct a nation-wide activity in industrial plants in an effort to improve industrial lighting conditions.

This activity will be conducted by representatives of all branches of the electrical industry and will have the following fundmental objects:

1. To organize an energetic direct-selling campaign to industrial plants on proper lighting installations.

2. To plan and put to work an advertising and promotional effort which is unified and thus more effective than individual efforts.

3. To go out and sell proper industrial lighting.

The industrial lighting committee is raising funds from manufacturers of industrial lighting equipment lamps and electric devices to formulate and carry out a program for selling industrial lighting equipment. In addition to formulating a complete plan the committee will carry on a campaign of industrial lighting advertising in national, business, management and class magazines; will furnish sales, lectures and advertising suggestions to assist local groups in carrying out their campaigns and will provide salesmen to explain the activity and assist in organizing the local groups.

In each geographic division of the National Electric Light Association a geographic chairman and a committee will be appointed to explain further the activity and assist the local groups in their efforts.

The definite services offered by the industrial lighting committee have been set forth in a plan book and can be used in part or in full by the local communities. The activity has been prepared so that it will be applicable to communities of any size. The cost of carrying out the activity in a local community will depend upon the size of the community, the number of industrial plants in the community and the extent to which participation is made in the campaign.

The national campaign is the first half of the activity to better the lighting of industrial plants. The local community does not necessarily have to go through all of the steps laid down by the industrial lighting committee, but should formulate

NATIONAL ADVERTISING BY INDUSTRIAL LIGHTING COMMITTEE

National	Class
Literary Digest	*Iron Age*
Business	*Iron Trade Review*
Nation's Business	*Foundry*
Forbes	*Metal Industry*
American Industries	*Automotive Industry*
Management	*American Lumberman*
Industrial Management	*Furniture Manufacturer and Artisan*
Industry Illustrated	*Textile World*
Manufacturers Record	*Paper Trade Journal*
Industrial Engineer	*Inland Printer*
	National Provisioner
	Hides and Leather
	Railway Age

some plan that will best fit the needs of the locality. In order to participate in the campaign the electrical interests in each community should form a local committee to handle the activity, or if an electrical league is already in existence, it could logically carry out this campaign. The plan has been made entirely flexible, so that the local committees may use it in whole or in part as they consider most advisable.

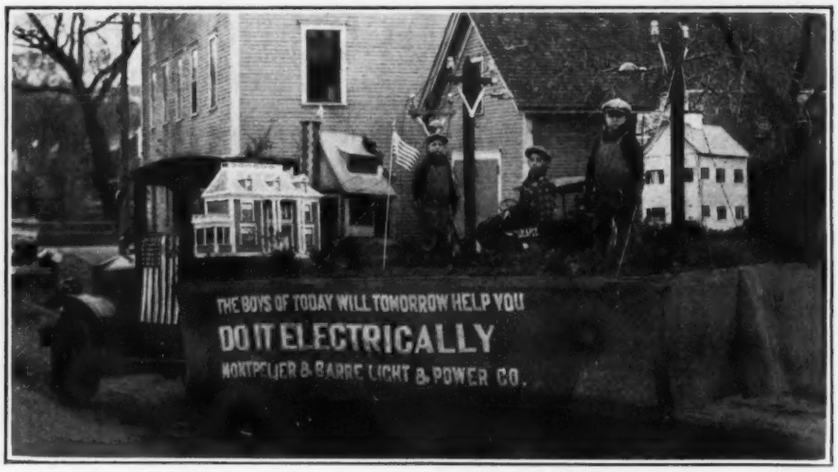
PLAN FOR LOCAL ACTIVITY

Against a carefully prepared "prospect" list of the industrial plants in each community needing better lighting a direct mail campaign should be launched to arouse the interest of the executives and plant engineers. For this purpose the industrial lighting committee is preparing three direct mail selling helps and an interesting booklet that points out in detail the benefits of proper lighting in the factory. In each of these selling helps is a coupon which offers a booklet on industrial lighting, as well as personal help in the executive's lighting problems. These mailing pieces will supplement the national advertising and the local newspaper advertising. They will bear the imprint of the local committee and will be ready for addressing and stamping upon their arrival.

A national advertising campaign is built around a series of advertisements in the *Literary Digest* depicting the four industrial lighting economies — increased production, decreased spoilage, fewer accidents and less labor turnover. It is planned to carry advertisements in the key publication in each industry as shown in the accompanying schedule, and the campaign will cover a total circulation of 1,500,000, with nearly 8,000,000 insertions. The industrial lighting committee will endeavor to have published in these magazines articles which will further emphasize the need for better factory lighting.

While the national advertising program will be most effective, the greatest good will be obtained for the local community if a parallel campaign in the local newspapers is conducted by the local electrical league or local organization. To assist in this campaign the industrial lighting committee will prepare a newspaper advertisement book which will suggest certain advertisements and supply at cost the necessary newspaper "mats."

Boys Portrayed as Utility Men of Tomorrow



THE Montpelier & Barre (Vt.) Light & Power Company entered the float illustrated above in a parade during the recent Boys' Week sponsored by Rotary Clubs throughout the country, thus tying the movement and public utility development together. Illuminated miniature buildings, a miniature street-lighting circuit supplied from storage batteries, three boys attired as linemen and a construction truck chauffeur made a most realistic scene. The float made such a "hit" with the local public that in response to many requests the company also operated the truck at night for a number of trips.

Several industrial lighting lectures will be prepared for presentation at Rotary, Kiwanis and similar club meetings and before small groups where the lighting demonstrations will not be available. A master lecture film on industrial lighting will be prepared and positive films or copies sold to the local organizations at cost, together with a small portable projector. These projectors will be used for carrying the message to individuals and small groups and will take the place of lantern slides or charts. A third lecture for use by demonstrators of lighting exhibits will accompany the prospectus that supplies the plans and details of lighting demonstrations.

For communities where there are a considerable number of industrial plants the industrial lighting committee will prepare complete plans and specifications for a demonstration and exhibit of proper lighting equipment for the factory. To this exhibit the executives and plant engineers of the industrial plants can be invited and the right and wrong methods of lighting can be shown to them. The industrial lighting committee also plans to have a motion-picture film prepared that will carry the story of industrial lighting in a most effective manner.

The committee will furnish forms for making factory layouts and to enable the local communities to obtain field notes of an industrial plant. A questionnaire accompanies the sheet, and if the questions are answered, enough information will be available to make it possible to recommend a better lighting plan. After the layout sheets and field notes have been obtained, some one designated in the local community should prepare the proper industrial lighting layout for the plant in question. The industrial lighting committee will furnish instructions for doing this, and the larger industrial centers will undoubtedly have men available who are experienced in this type of work.

NATIONAL PRIZES

In order to stimulate the local groups in the activity three prizes based upon the work done and the accomplishments of the individual committees are being offered. In order to compete for the prizes the local electrical leagues or local organizations will be obliged to submit a complete report of their activities so that a compilation of these reports will furnish information of value to the electrical industry.

All reports must be in the hands of the industrial lighting committee, National Electric Light Association, 29 West Thirty-ninth Street, New York City, by April 1, 1926. Announcement of the winners will be made on or before the regular 1926 N. E. L. A. convention. The points of award to be used in judging for prizes are:

1. Percentage of factories in communities brought up to a higher standard of lighting by the activity

in the period of the industrial lighting committee's program from September 1, 1925, to March 1, 1926.

2. Excellence of report based upon value to rest of the industry in facts and figures.

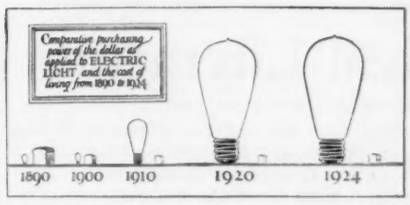
3. Evidence of an educational activity to industrial plants, civic and business groups on industrial lighting economies—that is, increased production, decreased spoilage, fewer accidents, less labor turnover.

The prizes are as follows: First prize, $2,500; second prize, $1,500; third prize, $1,000. The prize money will be given to the local electrical league or local organization conducting the activity to be used in any manner that it may wish. The judges of the contest will be announced later.

A plan book is being prepared outlining the complete activity, and may be obtained from the committee at the National Electric Light Association headquarters in New York.

Puget Sound Report Strikes Public Relations Note

THE recently issued report of the Puget Sound Power & Light Company, Stone & Webster, Inc., Boston, Mass., managers, departs widely from the usual production of this kind in the amount of space devoted to giving the stockholder a picture of the property and a clear-cut review of its "human interest" aspects. The report is a pamphlet of fifty pages, and besides numerous maps and half-tones of the property, it contains pictorial diagrams of the new Baker River development, the growth of loads on the system, in-


Comparative purchasing power of the dollar as applied to ELECTRIC LIGHT, and the cost of living from 1890 to 1924
1890
1900
1910
1920
1924

COMPARISON OF COST OF ELECTRIC LIGHT AND LIVING COSTS

increase in the generating capacity, number of customers and customer owners, which constitute so important a part of the company's recent history. Financial operations are exhibited in charts and tabular form, easily understood by the layman, and parts of the report picture the natural and economic advantages of the territory served by the company and tell the story of the business conditions therein during the past year.

The increased purchasing power of the dollar in electric service is compared with that of each decade for the past thirty-four years, and another unusual feature is a page of portraits of officers of the company prepared to enable stockholders and the public better to visualize those upon whom the responsibility for operations rests.

Taking the Public Behind the Scenes at Providence

FOR some months advertisements effectively picturing many features of utility service ordinarily unrealized by the public have been carried in the local press of Providence, R. I., by the Narragansett Electric Lighting Company. Two of the more recent displays are reproduced herewith. Emphasis is being laid upon the work of the distribution engineering department in connection with line extensions into new residential territory, the function of underground cable and manhole installations, how wiring installations are safeguarded by company regulations, supervision and insurance inspection, the magnitude of the pole inventory of the company and the importance of the lately completed Melrose service station. These advertisements tied in with

ADVERTISING TO INCREASE THE POPULAR KNOWLEDGE OF ELECTRIC SERVICE

the recent campaign for better home lighting, and were prepared under the general direction of F. A. Gallagher, Jr., manager of the lighting department of the Narragansett company.

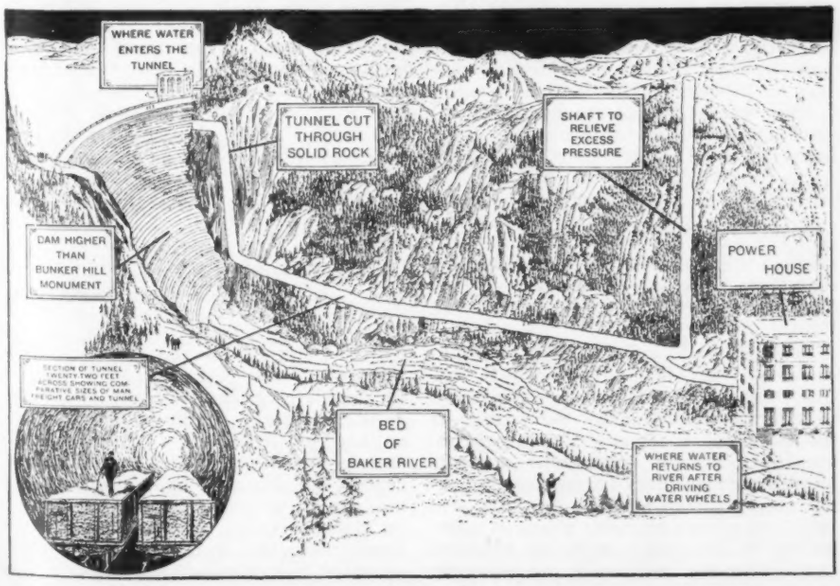

WHERE WATER ENTERS THE TUNNEL
TUNNEL CUT THROUGH SOLID ROCK
SHAFT TO RELIEVE EXCESS PRESSURE
DAM HIGHER THAN BUNKER HILL MONUMENT
POWER HOUSE
BED OF BAKER RIVER
WHERE WATER RETURNS TO RIVER AFTER DRIVING WATER WHEELS

DIAGRAM OF PUGET SOUND COMPANY'S BAKER RIVER DEVELOPMENT

Electrical Conveniences for Camping Parties

THAT the Borough Council of Tauranga, New Zealand, is an enterprising body is evident from the fact that in order to attract visitors to the district, and incidentally to increase the sale of electrical energy, the Council has freely circularized residents of the city of Wellington to the effect that if visitors will bring their own tents it will provide an attractive site for campers, with water supply and sanitary conveniences, and will connect up each tent for electric lighting and supply a small electric cooker at a very low rental.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Inexpensive Power and Hydro-Electric Development: Lessons from Switzerland and Italy.—HUGH QUIGLEY.—In this economic study the author selects the two countries named as representative of a régime of cheap power, Switzerland being examined from the point of view of power costs, Italy for the necessity of developing steam power to make good deficiencies of water power. The analysis is statistical and contains an abundance of data on costs, installation and kilowatt-hour output, chiefly as national totals or averages, not only for the countries mentioned but also for other countries as a matter of comparison. Consideration of this material, which cannot be here summarized, leads the author to conclusions as to the limit to the price at which electricity can be generated and sold. In Canada, owing to the abundance of water power easily harnessed, it is about 1.2 cents per unit, in the United States 1.8, in Switzerland 1.1, in Britain 1.2. Countries that are approaching the full economic utilization of their water powers are subject to the danger of limitation of their industrial output in low-water years. This is being felt in Italy and is bringing increasing advocacy of steam stations as reserves.—*World Power*, April, 1925.

Bow Power Station.—A description is given, with a number of illustrations, of the reconstruction, without interrupting operations, of this station of the Charing Cross Electricity Supply Company, which was originally a reciprocating-engine station. The present installation consists of one 16,000-kw., two 12,500-kw. and two 6,000-kw. units. The coal consumption has been reduced from 4.8 lb. per kilowatt-hour delivered to feeders in 1914 to 2.42 lb. in 1924.—*Engineer* (*England*), May 15, 1925.

Recent Developments in Hydro-Electric Generators. — F. D. NEWBURY.—Examples of recent forms of construction are given, with explanation of reasons leading to the choice of particular features of design, illustrated by means of cross-sections and views of recently built machines of large size.—*Electric Journal*, May, 1925.

Generation, Control, Switching and Protection

Flywheel-Type Generator.—B. KAUFMANN. — Rotors of synchronous generators which are driven by reciprocating steam engines or gas motors must have a sufficient amount of mechanical inertia to avoid fluctuations of the voltage. In most cases the rotor must be built much heavier than electrical and mechanical calculations would demand. The addition of a flywheel between the prime mover and the generator is considered bad practice, because it is very liable to introduce dangerous torsional stresses in the shaft. It is therefore necessary to put the additional weight more or less directly into the rotor. Hitherto it has been customary to provide heavy rims at either side of the pole wheel, so arranged that the diameter over the pole pieces was always the largest diameter on the rotor. The new design, described in this paper, provides a large flywheel which carries on one of its sides the pole wheel, itself much smaller in diameter. The stator is of about the same diameter as the flywheel, so that the assembled machine gives a pleasing appearance. This design has many valuable advantages, such as very much smaller weight when compared with the type formerly used, excellent cooling action and low cost of transportation, the latter being of particular importance for export.—*Siemens Zeitschrift*, April 1925.

Current-Limiting Apparatus for Small Consumers of Electrical Energy.—N. LEVENSON.—The author describes a current-limiting apparatus of his construction which is intended to be installed by the Petrograd central stations for small consumers where the use of electric meters proves to be too expensive. The main difference between the author's apparatus and that of others is that the slightest overload causes this device to switch off the current, the lamps having first flickered a moment. The connection can be reestablished by the consumer himself after the overload is removed. A special contrivance prevents any misuse of the device.—*Elektrichestwo*, No. 3.

Transmission, Substations and Distribution

Stability of Tower Foundations.—A. CHARDIN.—Steel transmission towers are usually anchored by being partly embedded each in a large cement block which is cast in the ground. No accurate method is known by means of which the proper size of this block can be determined. The formula most used states that the overthrow momentum of the tower is proportional to the cube of the total height (tower and block) times the *side* of the block. Elaborate tests by the author seem to indicate that the second factor of this formula is incorrect and that it should be replaced by the *volume* of the block. This corrected equation has been checked up on a large number of scale model towers and has been found to be not only fully dependable but to give as well the same degree of stability with a much smaller and consequently less expensive foundation block. — *Revue Générale de l'Electricité*, April 25, 1925.

Failure of Disk Insulators on High-Tension Transmission Lines.—HARRISON D. PANTON.—This is a supplement to a paper presented by the author at the A. I. E. E. Pacific Coast convention in 1922. It brings the analysis of insulator failures there reported up to date by including data for 1923 and 1924 and covers thirteen years of service by 31,164 disks, with an analysis concerning the position in the assembly of 5,995 failures. The results, presented in tables and curves, show that the smallest percentage of failures occurs on the second and the largest on the last insulator (next to the crossarm) in the string. — *Journal of A. I. E. E.*, May, 1925.

Impregnating Hammer for Wooden Poles. — R. NOWOTNY. — A few years ago a method was introduced in Europe to prevent, or at least to retard, rotting of wooden poles. By means of a specially designed machine a large number of small holes were drilled into the ground end of the new pole, and in each hole was injected a small amount of a special germ-killing liquid, which gradually seeped into the wood. As these holes were placed rather closely to each other, the entire end of the pole was thus impregnated with the liquid. Such good results were achieved with this "Cobra" method that a special small hammer has been developed with which erected poles can be treated. — *Elektrotechnische Zeitschrift*, April 9, 1925.

Units, Measurements and Instruments

Testing Porcelain Insulators.—W. BUCKSATH.—It is well known that transmission lines are subject to traveling waves or surges which break down insulators that have withstood the ordinary alternating-current test. Such a pressure surge makes its appearance suddenly at the lowest unit in a suspension string and is then reflected. During this period ionization of the lowest insulator takes place, and the latter may be more highly stressed if a small fault is present than when the insulator is tested with alternating current. The surge-testing equipment used at the Rosenthal porcelain works of Berlin to imitate actual conditions is described. The insulator unit is connected across one end of a long twin air-insulated line, the other end of which can be connected suddenly to a battery of condensers charged from an alternating-current generator through a high-tension transformer and a rectifier. Each time the battery is connected to the line a surge pressure is initiated which travels along to the insulator and is reflected. The magnitude of the surge and the steep wave front enable a higher pressure to be maintained during the ionization period than is possible with alternating-current testing. The mathematical theory of surge production is given in the paper, the actual manner of making the tests is described, and the results obtained are discussed. — *Electrician* (*England*), April 24, 1925.

Measuring of Dielectric Strength of Oil. — W. WELLAUER. — Testing the strength of oils depends on so many factors that greatly varying results will be obtained for the same oil. The author believes that disk electrodes or concentric cylinder electrodes will give more consistent readings than sphere or needle electrodes. A little-known fact is that the puncture voltage will depend considerably upon the time and manner in which the voltage is raised on the electrodes. For his very elaborate tests the author had a motor-operated induction-voltage regulator so

as to be assured that the rise of potential would be always uniform. He points out that the dielectric strength of an oil rises for the first few shots, reaches a maximum and then begins to decline slowly. It is suggested that seven punctures be made of an oil which is to be measured, that the first reading be discarded and that the average of the remaining six readings be taken. The author considers it entirely wrong to change the oil after each shot. After each puncture the oil should be stirred with a glass rod, and the electrodes should not be taken out of the oil.—*Bulletin de l'Association Suisse des Electriciens*, April, 1925.

Illumination

Symposium on Store Lighting.—At the meetings of the New York and Philadelphia Sections of the Illuminating Engineering Society in the early part of the current year papers were presented by several contributors showing proposed solutions of store-lighting problems previously submitted to them, containing the necessary data to make the problems specific. The present issue contains these solutions and the discussions thereon.—*Transactions of I. E. S.*, April, 1925.

Essentials of Good Street Lighting.—L. B. W. JOLLEY.—Part I of this serial deals at some length with the design of constant-potential multiple systems. Formulas are developed for the maximum difference in voltage between lamps when the group is fed at various points. Charts and discussions relate to the effects of variations in voltage, filament length and diameter, ratings and tolerance limits. Part II deals with series systems and with the mechanical as well as optical design and proper installation of the units.—*World Power*, March and May, 1925.

Motors and Control

Reducing Motor Failures at Syracuse by Better Maintenance.—L. E. WORLOCK.—Methods of repairing, dipping and baking armatures and other maintenance operations are described.—*Electric Railway Journal*, May 16, 1925.

Automatic Motor Clutch.—K. OBERMOSER.—To reduce the high-current peak when a three-phase motor with squirrel-cage armature starts with full load various automatic means of electrical and mechanical nature have been devised. A new type of the latter class is described in this paper. The clutch, which is built into the pulley, consists of four wedge-shaped ring segments lodged in suitable grooves within the inside rim of the pulley. The motor must be started with the stator Y connected. Reaching the highest speed for the Y voltage will advance the four clutch segments a certain distance, without, however, engaging the pulley with the shaft, because the segments are held back by four small noses over which they cannot slide. When the starting switch is thrown from the Y-position to the delta running position, the current will be broken for an instant, resulting in a momentary decrease of speed of the rotor. The inertia inherent in the four segments will be sufficient to overcome in that instant the resistance of the retaining noses, and the engagement between shaft and pulley will take place. In this way it is assured that the armature shall have time to come well up to speed before the clutch begins to grip. Speed diagrams illustrate the performance of this new pulley clutch.—*Elektrotechnische Zeitschrift*, April 9, 1925.

Heat Applications and Material Handling

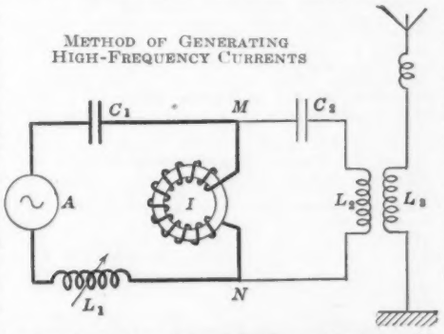
Load Building Possibilities of Industrial Heating.—C. L. IPSEN.—A summary of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. spring convention, April 25, 1925, on page 862. — *Journal of A. I. E. E.*, May, 1925.

Electrical Features of Inspiration's New Porphyry Hoists.—F. R. GRANT.—The equipment consists of two complete units, one for ore, the other for men and materials. The former is direct-current, 2,150 hp., 51 r.p.m., 650 volts, directly connected to the hoist drums. A motor-generator consisting of a 1,600-kw., 500-r.p.m., 650-volt generator, a 1,900-hp., 6,600-volt, three-phase, 60-cycle phase-wound induction motor and a steel-plate flywheel weighing 78,000 lb. supplies power to the hoist motor. The control equipment includes a slip regulator for the induction motor. The operation of this and other equipment is described, with reproduction of duty-cycle and retardation curves and wattmeter charts.—*Engineering and Mining Journal-Press*, April 18, 1925.

Telegraphy, Telephony, Radio and Signals

Method of Generating High-Frequency Currents.—G. W. O. HOWE.—During the last two or three years a new method of generating high-frequency currents has been developed in Germany which makes use of the peculiar properties of iron but, unlike the doubling transformers, gives a frequency that is a high multiple of the fundamental. This method is explained in non-mathematical form. The principle will be understood from the accompanying illustration, in which *A* is an alternator giving a frequency of about 10,000, *I* an iron ring of very thin laminations or fine wire, so designed that with normal excitation of the alternator the magnetization of the iron is carried far beyond the knee of the curve at each half cycle. The circuit is tuned to the alternator frequency by C_1 and L_1, the latter being a relatively large inductance, so that the current wave is fairly smooth, whereas the voltage across *I* has brief but pronounced peaks at the times of reversal of current. These pulses of voltage produce and maintain oscillations in C_2, L_2 which may be a high multiple, say the twenty-ninth harmonic, of the fundamental frequency. By interposing a tuned circuit between L_2 and L_3 neighboring harmonics are filtered out and not radiated. The efficiency of the system is increased by two tuned circuits in parallel with the ring, one at or near alternator frequency and another at a higher harmonic. The author discusses the reasons for this and mentions other features of the scheme, still in the developmental stage.—*Electrician* (*England*), May 8, 1925.

METHOD OF GENERATING HIGH-FREQUENCY CURRENTS



Traction

Railway Power Station at Barberine, Switzerland.—C. COHEN.—The electrification of all the main railroads in Switzerland will be completed in 1928. The supply of this extended railway system is being accomplished from one eastern and one western power center, into each of which a number of hydroelectric stations are feeding. The article under notice gives a detailed description of the largest western power house, which is at Barberine, near Lake Geneva. The water supply of the River Eau Noire, being subjected to extreme fluctuations, was made to feed a large storage basin, containing 37,500,000 cu.m., from which a pressure tunnel and a steel penstock lead to the power house, utilizing a hydraulic head of 2,500 ft., or a water pressure of more than 1,000 lb. per square inch at the turbines. At present three sets of 10,000-kva. waterwheel generators are running, with room for two more. The turbine is of the single-runner, single-jet Pelton type, driving a single-phase generator at 333.3 r.p.m. The machines generate at 15,000 volts at 16⅔ cycles, and their six-pole runners can withstand a maximum speed of 630 r.p.m. Generator and exciter weight complete 222 tons, of which 80 tons is revolving. The machines are completely inclosed and self-ventilating. Without intervening oil switches each generator is connected to a 66/15-kv. single-phase transformer. All apparatus is installed indoors. Automatic voltage control on all generators simplifies the attendance problem. The operating room is so situated as to be totally remote from noise or view of the machines, a feature which is held to be of great value in that it helps the operators to keep cool in case of serious engine trouble. One pole on both the 15-kv. and 66-kv. systems is permanently grounded as an effective means of protection against overvoltage; but the arrangement is so made that in case of a failure or flashover no dangerous ground currents can develop between ground plate and fault.—*Brown-Boveri Mitteilungen*, April and May, 1925.

Economies Expected from Electrification of Virginian Railway.—The nature of the anticipated economies is stated, though not their magnitude. Specifications are listed for the 425,000-lb. units. They are described and a profile of the road is added, showing the heavy grades.—*Electric Railway Journal*, May 30, 1925.

Scientific & Industrial Research

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Control for Industrial Motors

An automatic compensator with time-element acceleration and thermal-overload relay was designed, to replace the type utilizing current-limit acceleration and dashpot retarded overload relays.—*General Electric Company, Schenectady, N. Y.*

Copper, Electrolytic, Softening of Hard-Rolled

An investigation has been made of the several combinations of cold-rolling and annealing treatments best suited for the production of highly ductile copper, including softening at fixed temperatures, the effects of excess heating at softening temperature and the effect of cooling rate following annealing. The strongest completely annealed copper is the most ductile, and to achieve this the annealing temperatures must be kept low.—*N. B. Piling and G. P. Halliwell, American Society for Testing Materials, Philadelphia, Pa.*

Distant Dial Mechanism

The General Electric Company has developed a distant dial mechanism for use with watt-hour meters where, for various reasons, it is desired to have the registration of the meter appear at a point quite remote from that where it is installed. It is actuated through a contact mechanism in the register of the watt-hour meter.—*National Electric Light Association.*

Heat Loss, Variation of, with Gas Pressure

The amount of heat carried away by air at various pressures has been measured for a wire axially placed in a horizontal cylinder 8 in. in diameter. The results agree fairly well with those of Kennelly, the exponent of pressure being about 0.3 instead of the theoretical value of 0.5. However, for low pressures, of the order of 1 mm., the loss varies as the square root of P until the pressure is reduced to a value such that the mean free path of the gas molecules is greater than the radius of the cylinder. The losses then vary directly as the pressure. Extrapolation of the losses for such low pressures give the radiation losses. From this the radiation constant can be determined for insulating materials and surfaces used in electrical machines. Knudsen's equation for molecular conduction is found to check with the above extrapolation.—*Charles F. Hill, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

Metals, Ferrous, Fatigue of

Existence of fatigue limits has been established and values have been determined for the common grades of wrought ferrous metals, including many alloy steels. The interesting fact has been brought out that these limiting stresses for wrought ferrous metals bear a definite relation to the ordinary tensile strength of the steel and to its Brinell hardness. Endurance limits have been determined for steel under repeated flexural stress, for steel under repeated shearing stress and for steel under cycles of alternating tension and compression.—*H. F. Moore, Urbana, Ill.*

Radio Transmission at Extra High Frequencies

Tests were made to establish the merits of radio transmission at frequencies differing widely from those now in general use for broadcasting. Most of this work was devoted to transmission at very high frequencies, up to 20,000,000 cycles. The results indicate that these frequencies hold some promise for radio relaying and for transmitting over great distances under certain conditions.—*General Electric Company, Schenectady, N. Y.*

Synchronous Machines, Damper Winding for

An improved type of damper winding has been developed which has all the advantages of the welded joint and the mechanical strength of the solid end ring. The bars are welded to copper segments of angle section, and the segments are bolted to a continuous rolled copper ring. For details see the *Electric Journal*, 1925, Vol. 22, page 196.

Transformer Current, Two-Stage

A two-stage Brooks-type current transformer for 4,500 volts in capacities from 5 amp. to 600 amp. has been developed by the General Electric Company. This is a multi-turn transformer primarily designed for use in connection with a single watt-hour meter where the highest grade of accuracy is desired. With much higher secondary burdens, the accuracy is at least equal to or greater than that obtained with the highest grade of the standard type of transformers. A very important application of the two-stage transformer is a single-turn or through type having metering accuracy in capacities as low as 150 amp. or 200 amp. This development is of particular importance as the single-turn transformer has considerably higher short-circuit capacity that the multi-turn type.—*National Electric Light Association.*

In Progress or Purposed

Bakelite, Its Optical Behavior Under Mechanical Stress

Celluloid shows a hysteretic behavior in its stress-train properties. While hysteresis effects could be compensated for in the photo-elastic method of solution of stress problems, a material in which hysteretic behavior is absent would be of decided advantage. Isotropic transparent Bakelite has a linear stress-strain curve and shows no hysteresis effects. Its physical constants are being investigated.—*Paul Heymans, Massachusetts Institute of Technology, Cambridge, Mass.*

Circuit-Breakers, High-Speed

Important advances have been made in the development of high-speed circuit breakers. These breakers, developed initially for alternating-current railway electrifications, will open the circuit under transient abnormal conditions in less than one cycle. Where the conditions will permit of their installation, these breakers will be useful in reducing the difficulties heretofore experienced in some cases from acoustic shock.—*National Electric Light Association.*

Electroplating, Research in

Satisfactory progress is being made in the study of nickel electroplating. Solutions of known composition have been installed in two local electrotyping plants and are being kept under close supervision and observation. The results so far obtained in the study of the protective value of nickel plating upon iron and steel are being assembled. Satisfactory progress is being made in the application of chromium plating at the Bureau of Engraving and Printing, although the actual service results are not yet available. Experiments are being made to determine the accuracy of the usual method of stripping silver from silver-plated articles in order to determine the weight of silver present. A study of the operation of zinc plating solutions will shortly be undertaken.—*Bureau of Standards, Washington, D. C.*

Heating Wire, Life Tests on

The executive committee of this society has authorized the calling of a conference to consider the standardization of methods of life tests of electric heating wire. One of the companies producing this wire has suggested the need for such standardization, and an investigation of the project points to the conference as the most satisfactory means of determining the necessity and importance of this work.—*American Society for Testing Materials, Philadelphia.*

Radio Wave Phenomena, Co-operative Investigation of

The details of future co-operative tests will be determined by the cumulative results of the completed tests. Laboratories interested in measurements of radio wave phenomena are invited to communicate with the bureau relative to participation in the investigation. The apparatus required for recording signal intensity variations can be constructed for the most part from the equipment of the average college or commercial radio laboratory. Measurements of field strength and direction require somewhat specialized apparatus.—*Bureau of Standards, Washington, D. C.*

Rectifiers, Aluminum, Improvements in

Royer has proposed the following improvements, which have greatly increased the efficiency of aluminum rectifiers: (*a*) the use of an electrolyte containing from 50 to 200 grains of tartaric acid per liter of water; (*b*) metal containers lined with heat-resisting enamel; (*c*) external water cooling. For details of experiments see *Recherches et Inventions*, April 1, 1925, page 429.

Suggestions for Research

Alternators, Protection Against Short Circuits Between Turns

This is a common cause of failure, and there seems to be considerable doubt as to the action of the balanced current and balanced potential systems of protection in the case of a short circuit in a single turn or coil. Neither the balanced-potential nor the balanced-current systems should, further, operate on an external short circuit, due to the fact that the parallel branches of the winding lay on different parts of the circumference of the machine. Either of these systems might nevertheless respond probably while the flux conditions become unsymmetrical.—*Donald Bratt, Brooklyn Edison Company.*

Communication in Coal Mines

Reliable communication with distant portions of a mine is of paramount importance, particularly after an accident. After an explosion or fire overhead wires are usually broken or destroyed, and only buried metallic conductors remain, such as electric cables, water and air pipes, etc. The United States Bureau of Mines has been conducting an extensive investigation on the use of such conductors for carrier-current communication, and those who wish to participate in this work should write to Bureau of Mines, Pittsburgh, Pa., for available reports of tests.

Interference with Radio, Location of Sources of

One of the well-known sources of interference with radio receiving is defective wiring of light and power circuits. Among other sources are thermostatic control devices, telephone ringer generators, small battery-charging sets, overhead trolley construction at switch points, etc., various groups of interests would like to have simple and positive methods for the location of sources of such interference, and a systematic study of these sources and of the means of their detection and discrimination is desired.

Turbo-Generators, Gas Cooling of

The desirability of cooling with a different gas than air becomes evident for various reasons: (*a*) It might reduce fan losses and therefore increase the efficiency of the generator; or it might make it possible to use a smaller machine for the same rating. (*b*) It might reduce the fire risk in case of short circuits inside the windings. (*c*) It might permit increase in generator voltage. (*d*) It might make possible a better utilization of feed water, depending on the local conditions, resulting in increasing steam efficiencies. From a preliminary study it would seem that hydrogen possesses some marked advantages over air.—*Donald Bratt, Brooklyn Edison Company.*

Welding, Checking Results and Operators in

There are two subjects of vital interest to the welding industry. On the satisfactory solution of these two subjects depend further extensions of the use of welding. The two subjects in question are: (1) Methods to be employed by various industries in inspecting their welding work; (2) methods employed by various industries in checking up and testing the skill of their welding operators. For the present status see the *Journal*, 1925, Vol. 4, pages 47 to 60. —*K. H. Condit, American Welding Society.*

News of the Industry

Saratoga Meeting of Institute Draws Well

Excellent Technical Sessions—Water-Power Problems Arouse Great Interest—Wyer Holds Up Mirror to Muscle Shoals—Lee Tells of Saguenay Development

WITH a registration of more than 850 members and visitors and a highly diversified program of work and entertainment, the annual convention of the American Institute of Electrical Engineers opened on Tuesday of this week at the United States Hotel, Saratoga Springs, N. Y. Noteworthy advances in power-plant design, transmission, electrical measurements and communication were recorded in papers and reports at the technical sessions, and a fine entertainment program provided recreation. The outstanding feature of the convention was the general water-power session on Wednesday evening, at which addresses by S. S. Wyer, consulting engineer, Columbus, Ohio, on "The Truth About Muscle Shoals," and W. S. Lee, vice-president and chief engineer Southern Power Company, on "The 540,000-Hp. Hydro-Electric Development at Ile Maligne, Quebec," aroused keen interest.

In his opening address President Farley Osgood stressed the obligation of engineers to render a broader service and urged more participation in public affairs. He emphasized the desirability of larger technical representation on commissions and in legislative bodies.

Power-plant development and transmission received extended attention at the first technical session on Tuesday, emphasis being laid upon successful efforts to build for greater efficiency and reliability of operation. The discussions brought out the value of the overhead ground wire in preventing flashover from lightning, the importance of the careful handling of conductors during installation to prevent their roughening with consequent increased corona losses, the comparative merits of different methods of generator excitation and the need of more reliable service from the cables of recent manufacture. Central-station men present severely criticised the quality of modern cable design and construction. A representative cable manufacturer contended that definite progress is being made in the reduction of instability in insulation compounds which tends to shorten the life of cables under prolonged voltage stresses. Research, measurements and electrical machine design were also discussed briefly at this session.

Engineering relations with modern industry occupied a large part of the second technical session on Wednesday. Trends of practice in electrification of the iron and steel industry, in mining, lighting, electrochemistry and communication were set forth. An important recommendation from the committee on marine applications urged the redrafting of coastwise and inland waterway regulations to compel a deeper recognition of the responsibility of electrical men on vessels.

A comprehensive survey of the economic possibilities and political aspects of Muscle Shoals was given by Mr. Wyer. The speaker set forth the widespread popular misconceptions concerning the value and importance of this water-power site which have so long prevailed. He asserted that Muscle Shoals could be made part of an integrated, interconnected transmission system, so that the advantageously located steam plant and storage reservoir could be used for supplementing the otherwise practically valueless secondary power. He declared that no one would pay $49,000,000 for the Wilson Dam and therefore the government cannot get its money back; that the price of steam power will fix the maximum price which the water power will command, and that the only solution is to lease the dam to the best bidder and pocket the losses on the project as a war cost.

The vital importance of co-ordinating design and construction in great water-power developments was outlined by Mr. Lee, who described the Ile Maligne development on the Saguenay River, in Quebec, now rapidly approaching completion. On this project the cost of construction equipment exceeded a million dollars, but this expensive equipment so expedited the work that more than three million dollars in interest and revenue from the sale of power was saved. The cost of the plant will be less than $60 per kilowatt, Mr. Lee asserted, and the output is already almost all sold to industrial and electrochemical interests. Work is beginning on the second plant of 600,000 hp. rating below the present station.

On Thursday and Friday the program included papers on oil circuit breakers, transmission and distribution, electrical measurements, research and standardization problems. A more extended report of the technical sessions and discussions will be published next week.

ENTERTAINMENT AND TRIPS

The delegates and their wives availed themselves fully of Saratoga's abundant opportunities for entertainment, many visiting the Saratoga and Schuylerville battlefields, journeying to Lake George for a boat trip and enjoying the outdoor amusements and the opportunities for dancing. Inspection trips included a visit to the works of the General Electric Company at Schenectady, to the Green Island low-head hydro-electric plant of the Ford Manufacturing Company, and to three plants of the Adirondack Power & Light Company—the steam plant at Amsterdam, where a third 30,000-kw. unit is being installed; the hydro-electric plant on Sherman Island and the high-tension substation at Rotterdam.

Byllesby Interests Acquire the Duquesne Light Company

The agreement first reported as probable six months ago (ELECTRICAL WORLD, January 3, page 61), by which a newly organized Byllesby holding company, the Standard Power & Light Corporation, would take over control of three associated companies, the Pittsburgh Utilities Corporation, the Philadelphia Company and the United Railways Investment Company, has now been consummated in co-operation with Ladenburg, Thalmann & Company, New York bankers. The new holding company will be known as the Standard Power & Light Corporation (of Delaware), and holders of the trust receipts of the previously organized Standard Power & Light Corporation (of Maryland) will be asked to exchange their holdings for shares of the Delaware company.

This move is, as pointed out before, of particular interest because it will bring with it to the Byllesby interests control of the Duquesne Light Company of Pittsburgh and thus give these interests a large central station in Eastern territory, their operations having hitherto been confined to the Middle West, South and Pacific Coast. The Duquesne Light Company is a subsidiary of the Philadelphia Company, which also owns a number of street railway, gas and miscellaneous utilities. The Philadelphia Company is controlled by the Pittsburgh Utilities Corporation, which is itself controlled in turn by the United Railways Investment Company.

Great Western to Build 220-Kv. Sacramento-Merced Line

Construction of a 220-kv. transmission line by the Great Western Power Company from Sacramento to Merced, Cal., awaits only the approval of the Railroad Commission, according to an announcement just made by J. B. Black, vice-president of the company. The line will be 104 miles in length and will tie together the systems of the Great Western Power Company and the San Joaquin Light & Power Corporation, which were recently consolidated. The cost, including substation equipment, will be approximately $2,750,000. Steel towers of the double-circuit type with one circuit installed will be erected. The line will operate initially at 165 kv., but will be designed for operation later at 220 kv. A carrier-current telephone system will be installed for communication service. Construction of the tie line now about to start and the use of

existing interconnections with other companies will make power generated at the Great Western plants on the Feather River available in large quantities in the San Joaquin Valley as well as other parts of the state.

Lighting Fixture Men Reject Plans for 1926 Market

The plan prepared by a committee for a 1926 "lighting fixture market," as reported last week (page 1359), and introduced at a joint luncheon of the National Association Lighting Equipment Dealers, National Council Lighting Fixture Manufacturers, Illuminating Glassware Guild and Associated Lighting Equipment Salesmen at Atlantic City on June 17 was adopted by the dealers' association and the glassware men, but was rejected by the lighting fixture manufacturers, who felt that a 1926 market was not expedient.

The new officers elected by the National Council Lighting Fixture Manufacturers are: President, William Horn, Philadelphia; vice-president, J. William Schulze; secretary, Charles Hofrichter (re-elected); treasurer, B. F. Klein, (re-elected). Election of officers for the other associations was deferred, the incumbents holding over.

New Project on Saguenay Is Rated at 600,000 Hp.

It has been officially announced by the Quebec government that an agreement has been reached between that government and the Duke interests which will clear the way for proceeding with the huge hydro-electric development at Chute à Caron Falls in the Lake St. John district, at the mouth of the Saguenay. The government has given its approval of the development of 600,000 hp. at this site. According to present plans, approximately $75,000,000 is to be expended ultimately on power development and the construction of a plant for the manufacture of aluminum. Initial expenditure is put as high as $40,000,000. This project was noted in the ELECTRICAL WORLD for June 6, page 1231.

General Electric Investigation May Strike Snag

All members of the staff of the Federal Trade Commission have been instructed to expend no funds of the commission "upon an investigation requested by either house of Congress alone" unless the resolution alleges a violation of the anti-trust statutes. This order was issued to comply with a condition attached to the act appropriating the commission's funds for the fiscal year beginning July 1. Several of the investigations now being conducted by the commission are in response to Senate resolutions in which the House of Representatives did not concur. Among these is the Norris resolution ordering an investigation of the General Electric Company. Whether or not that resolution, as well as others, contains an allegation of violation of the anti-trust statutes has been submitted to the Attorney-General for an opinion.

A. S. T. M. Attacking Corrosion of Iron and Steel Wires

Speaking at the annual meeting of the American Society for Testing Materials, held at Atlantic City from Tuesday to Friday of this week, Frank F. Fowle, consulting engineer of Chicago, whose subject was "Accelerated Corrosion Tests on Bare Overhead Electrical Conductors," said that an effort was to be made to prevent corrosion of galvanized iron and steel transmission wires by coating them. Stations for experimentation are to be established in five different sections of the country, giving every possible variety of climatic conditions.

A committee report, presented by J. H. Gibboney of Roanoke, Va., said that, following experimentation extending over the last nine years, engineers of the society had found that iron and steel were almost rustless when a small amount of copper was mixed with them. The committee announced that with these experiments upon raw iron and steel virtually finished, it was starting an extensive research program to determine the proper coating to place upon iron and steel products, preventing rust in that way also.

Both by official announcement of the society and in the annual address of President Frank M. Farmer of the Electrical Testing Laboratories, New York City, it was declared that the organization was successfully working toward nation-wide adoption of "standard specifications and methods of testing materials used in industry," assuring protection of both consumers and producers. The society has formulated more than four hundred standard specifications and tests of materials, it was said, which are widely circulated throughout the country and have been translated by the government into Spanish, French and Portuguese as representative of American standard practice in relation to export trade.

More than a thousand delegates, representing many lines of industry, attended the convention, hearing the reports of thirty committees of engineers. Newly elected officers are W. H. Fulweiler of Philadelphia, president, and H. F. Moore, professor of engineering materials, University of Illinois, vice-president.

Permissible Diversion at Niagara Not Exceeded

The withdrawal of water for power purposes on either side of the Niagara River has not exceeded treaty limitations, according to the report of the Niagara Control Board, which has just been issued by the Canadian government. The report says that whereas the treaty permits a daily diversion within New York State of 20,000 cu.ft. of water per second, this diversion has at no time exceeded 19,500 cu.ft. Further, the report expresses a belief that the 500 sec.ft. reserved for the Barge Canal has not been exceeded. On the Canadian side of the river, the report goes on, the diversion of water has at no time exceeded in the aggregate a daily diversion at the rate of 36,000 cu.ft. per second.

The board was appointed two years ago by the two governments to obtain co-operation in controlling the amount of water diversion under the provisions of the boundary waters treaty between Great Britain and the United States signed on January 11, 1909. J. T. Johnson is the Canadian member of the board and P. R. Reinicke is the American member.

New Substations for Los Angeles Power Bureau

Announcement has been made by the Bureau of Power and Light of Los Angeles of a program involving the expenditure of $21,000,000 for extensions and betterments to the distribution system. Work is to begin at once on twelve new substations to cost approximately $2,500,000, which will have an initial installed capacity aggregating 75,000 kva. and will transform power from 33,000 volts to 4,400 volts. These stations will be built at important distributing centers and will be of the most modern type. Seven of them will have a steel frame finished with stucco and a concrete roof. Four will be of reinforced concrete.

During the coming year 4 miles of 33,000-volt underground cable, 4 miles of low-voltage cable and 50 miles of 33,000-volt overhead lines will be built.

Hetch Hetchy Pact Approved by San Francisco Supervisors

Temporary distribution of Hetch Hetchy power through the lines of the Pacific Gas & Electric Company has been approved by the Board of Supervisors of San Francisco. An ordinance authorizing the city to enter into the proposed contract by which the city will receive approximately $2,000,000 a year for its electrical energy from the Moccasin plant was passed to print by a vote of eleven to seven on June 19. In the period intervening before the final passage of the ordinance the contract will be taken to Washington and submitted to the Secretary of the Interior for approval to make sure that the provisions of the Raker act, the congressional act granting San Francisco its Hetch Hetchy rights, are not violated.

This action of the Supervisors breaks a deadlock with the power company over the price to be paid for the power which ensued after the meeting of the Supervisors' committee noted in these columns on June 13. A demand of $2,583,000 made by the city for Hetch Hetchy energy was flatly refused by the power company on the ground that the power was worth no more than $2,000,000 to it. Certified copies of contracts with irrigation districts and private utilities were submitted showing that the company is purchasing power at a lower rate per kilowatt-hour than that offered for Hetch Hetchy.

San Francisco's 70,000-kw. Moccasin power plant is completed and ready for operation; its transmission line to the Newark substation of the Pacific Gas & Electric Company is ready to be tied in, and delivery of power now awaits only final action on the contract.

Muscle Shoals to Produce by August 1

Four 30,000-Kw. Units Are Now Ready for Testing—Conditions Formulated Under Which Power May Be Purchased During the Testing Period

GENERATION of power at Muscle Shoals will begin the first week in August, according to General Harry Taylor, the Chief of Engineers. This will make it possible to test out one generator at a time. The power thus developed will be intermittent. The generator will have to be shut down frequently without advance notice, it is expected, but representatives of the Southeastern power companies who conferred with General Taylor at Muscle Shoals committed themselves in writing to take whatever power may become available incident to the testing of the machinery. Such a plan was carried out successfully at the Ford plant at the government dam in the Mississippi at Minneapolis. The Northern States Power Company is continuing to absorb into its system the surplus power developed at that dam.

Four 30,000-kw. units are in place ready for testing. It will not be possible to operate more than one at a time until the permanent switchboard is completed, which will be in December. As transmission line capacity is only 40,000 kw., the total output of two units could not be transmitted away from Muscle Shoals. Such hydro-electric power as becomes available will make it possible to shut down some of the steam. Fires can be banked and some saving of coal effected, but the plant's personnel will have to be held in readiness to take over the load at any time. Even under these conditions General Taylor expects that a considerable revenue will accrue to the government from the sale of power.

One uncertainty of the situation is the low river. Some time is going to be required to bring the pool up to operating level. Were this process undertaken too rapidly it would cut off too much water from the river below. It seems entirely practicable, however, to take enough water from the river gradually to fill the pool by August 1.

CONDITIONS OF SALE OF POWER

General Taylor has sent to the Southern power companies and others interested a letter stating as follows the conditions that will govern the sale of power:

(a) No lease or agreement will be entered into.

(b) The government will not undertake to supply a stated amount of power for any definite period.

(c) The power will be available only during the tests and the tuning up of the equipment.

(d) Operation of the generators may be commenced or discontinued whenever the officers in charge of the plant consider it to the best interests of the government to do so. As far as practicable, reasonable notice will be given when operation of the plant will be commenced or discontinued, but it is anticipated that during the tests there may be occasions when it will be necessary to close the plant down with little or no notice.

(e) The government has under construction a high-tension line connecting the hydro plant with the steam plant at Nitrate Plant No. 2. The steam plant is provided with a complete switchboard and all necessary apparatus for transmitting power to Nitrate Plant No. 2 or to distant communities over high-tension lines. The transformers for raising the current from the hydro-generator voltage to line voltage are not available, and it will be necessary for the purchaser of power from the hydro plant to supply the transformers and certain other apparatus before use can be made of the power. The installation of the transformers and other necessary apparatus must be completed by August 1.

(f) The transformers and any other apparatus furnished by the purchaser of the power for use during the testing period may be removed when the tests are completed. The installation, operation and removal of the temporary equipment shall be in such manner as will not unduly delay or interfere with the installation of permanent equipment for the project.

(g) The installation and removal of the temporary equipment will be at the expense of the purchaser of the power, but credit will be allowed for a reasonable cost of this installation in power furnished at the unit price, provided that, if the amount of power purchased at the price agreed upon does not amount to the cost of the installation and removal of the temporary equipment, any excess cost shall be borne wholly by the purchaser of the power.

(h) The main switchboard leads, circuit breakers, etc., are now being installed, but the installation will not be completed before December 1. Prior to that time temporary connections will be made to the generators so that one generator at a time can be connected up and tested. No provision will be made for connecting in more than one unit at a time.

General Taylor explains that any person interested in obtaining power at Muscle Shoals may have an opportunity after June 30 to make investigations on the ground, but he would like to have the declaration of desire to purchase power prior to that date.

Distribution of Muscle Shoals power for public utility use, with provision for prior use for fertilizer manufacture, is recommended by the Tennessee Manufacturers' Association in a letter to the President's Muscle Shoals Commission.

Indianapolis' New Street-Lighting Installation

Nearly 40 miles of thoroughfare in Indianapolis will soon have a new system of street lighting. Illumination in the downtown district is to be increased twenty times and that on main arteries ten to twelve times. About 2,300 standards, 3,000 pendent units and 550,000 ft. of cable will be necessary for the change. On the downtown streets 225 20-ft. double-unit standards will be used. On residential and less-traveled streets 1,149 12-ft. standards will increase the present lighting by 1,000 per cent. Except in the case of nearly 400 of the single-unit arc lamps and the incandescent lamps, all standards will be placed 105 ft. apart.

Of the double-unit arc standards, sixty-nine will operate on a 4,000-hour basis and 130 on a 2,000-hour basis. Of the single-unit arc standards 413 will

NEW 20-FT. STANDARD IN INDIANAPOLIS

operate on a 4,000-hour basis and 620 for 2,000 hours. More than 300 600-lumen incandescent standards will operate 4,000 hours and half this number for 2,000 hours. Over 460 4,000-lumen incandescent units will operate 4,000 hours and 230 2,000 hours. There will be, besides, 2,200 10,000-lumen and 800 6,000-lumen pendent lamps installed at intersections for 4,000-hour operation where arc lamps are now used.

Enlargements of the main ducts in the downtown streets are being made. Public annoyance because of torn-up streets is mitigated by signs labeled, "This is a sign of progress." The Merchants' Heat & Light Company has the contract for supplying the energy. Frank C. Lingenfelter is city engineer of Indianapolis.

Conowingo Up Again

Pennsylvania Commission Renews Its Hearings, Calling for More Details of Plans

A RESUMPTION of the hearings on the Conowingo hydro-electric project, in which the Susquehanna Power Company and the Philadelphia Electric Company are interested and which has been attacked by the Philadelphia Rapid Transit Company, was set by the Pennsylvania Public Service Commission for Friday, June 26. The Maryland Public Service Commissioners were to attend the meeting.

In announcing the renewal of hearings the Pennsylvania commission issued a report signed by S. R. Shelby, acting chairman, in which it was asserted that adequate regulation of the rates and practices of the promoting companies will be very difficult under the present intricate "corporate set-up." Changes in the plans to make such regulation possible are asked. The commission also suggests that the applicants try to find means of reducing the proposed construction costs, and more information is asked on both the proposed engineering changes at the dam and the present plan for financing the project. The commission raises the question whether the present plan is the most economical possible and asks more information in regard to the item of $4,450,240 for "pre-license," or promotion, cost of the Susquehanna Power Company.

The Federal Power Commission does not share the view that the minor changes made in the plans for the dam at Conowingo are such as to require any review of previous action or the extension of any further rights. In virtually all cases that come before the Federal Power Commission some perfecting of the plans is required after the license has been authorized.

Colorado Streams Surveyed

Interior Department Reports Estimate Power on Taylor, Eagle and San Miguel Rivers

IN A MANUSCRIPT report, prepared for the Department of the Interior, on the water-power resources of Taylor River, in Colorado, a hydraulic engineer of the Geological Survey presents a plan by which Taylor Park reservoir could be used to equalize the flow of the river for generating power and at the same time for increasing the supply of water for irrigation late in the season. Even without a reservoir, by constructing low dams and conduits the unregulated flow could be used to generate 17,000 hp. for 50 per cent of the time and 10,000 hp. for 90 per cent of the time. If the flow should be regulated by a reservoir at Taylor Park, 33,000 hp. could be generated for 50 per cent of the time and 31,000 hp. for 90 per cent of the time.

Another engineering report prepared in the department indicates that the potential power of Eagle River, Colorado, below Red Cliff amounts to 28,000 hp. for 50 per cent of the time and 13,500 hp. for 90 per cent of the time, whereas only 325 hp. is now utilized. The total fall of the river from Red Cliff to its mouth, a distance of 53 miles, is 2,440 ft., almost all of which could be utilized in fourteen proposed water-power plants. The flow of this river for 90 per cent of the time increases from 26 sec.-ft. at the uppermost site to 150 sec.-ft. at the lowest site. The flow for 50 per cent of the time increases from 62 sec.-ft. at the uppermost site to 290 sec.-ft. at the lowest one. Power could be developed by means of open conduits or pipe lines. These conduits would average several miles in length, but the cost of construction should not be high because of the low capacity required. The diversion dams proposed would be inexpensive rock-fill or concrete structures about 4 ft. high.

FALL OF 2,573 FT. IN SAN MIGUEL

The discovery of deposits of precious metals on the North Fork of the San Miguel River, also in Colorado, in 1874 and 1875 caused a rush of prospectors and miners to that locality. Later, to supply the demand for power and light in the mines, seven water-power plants having an installed capacity of 11,400 hp. were constructed in the basin of San Miguel River. All but one small plant are built on small tributaries above Sawpit. The San Miguel is a tributary of the Dolores River, which in turn is a tributary of the Colorado. It flows in a canyon 1,000 ft. to 2,000 ft. deep and is bordered by very little bottom land. In the 64 miles between Sawpit and its mouth it has a fall of 2,573 ft. The steepness of the slope of the stream and the narrowness of the alluvial valley prevent the storage of the water, but the natural flow and the fall below Sawpit are so great that 30,000 hp. could be produced for 50 per cent of the time and 16,600 hp. for 90 per cent of the time.

The potential power will probably be made available by low diversion dams and canals that will have a capacity of 100 sec.-ft. to 200 sec.-ft. At one site a canal 7 miles long, having a capacity of 150 sec.-ft., would make available a head of 470 ft. and the potential power would amount to 5,600 hp. for 50 per cent of the time and 2,820 hp. for 90 per cent of the time.

Pacific Coast Associations Elect Officers

Although the big national convention of the N. E. L. A. occupied the center of the stage in San Francisco last week, the Pacific Coast Electrical Association found time to hold a short business meeting on Monday morning for the election of officers. William Baurhyte, president of the Los Angeles Gas & Electric Corporation, was elected president to succeed Frank A. Leach, Jr.; S. Waldo Coleman, Coast Counties Gas & Electric Company, was named first vice-president, and W. L. Frost, Southern California Edison Company, second vice-president.

Before leaving Portland for the convention members of the Northwest Electric Light and Power Association met and elected Lewis A. Lewis of the Washington Water Power Company, Spokane, president. He will succeed R. M. Boykin of the Puget Sound Power & Light Company, retiring president.

American Association of Engineers Elects Officers

Representatives and members of the American Association of Engineers met in annual convention at Orlando, Fla., June 2 to 5. Harold Almert was appointed general manager and secretary by the board of directors, and M. E. McIver was appointed assistant secretary. Henry W. Clausen was reappointed treasurer. The following additional national officers were installed at the banquet, which was the last meeting of the convention:

President, Dr. D. B. Steinman, New York; past-president, Morris Bien, Washington, D. C.; first vice-president, O. Laurgaard, Portland, Ore.; second vice-president, Wallace R. Harris, Chicago; national directors, O. H. Kneen of Seattle, A. M. Knowles of New York City, H. G. Culverhouse of Birmingham, Donald M. Baker of Los Angeles, C. J. Ullrich of Salt Lake City, A. A. Prendergast of St. Paul, H. A. Wagner of Mayer, Ariz.; Victor Cochrane of Tulsa, Okla.; R. C. Kellogg of Oak Park, Ill.; Arthur Richards of Chillicothe, Ohio; H. J. Spelman of Huntington, W. Va., and E. I. Gardiner of Natick, Mass.

Boulder Dam Association Still Actively at Work

More than two hundred representatives of civic and community organizations of California, Arizona and Nevada came together at the annual meeting of the Boulder Dam Association at Ontario, Cal., on June 13. This organization has as its object the putting through Congress of the Swing-Johnson bill, providing for the construction by the federal government of a high dam at Boulder Canyon on the Colorado River.

Mayor John L. Bacon of San Diego, president of the association, introduced Arthur P. Davis, former head of the United States Reclamation Service, who as the principal speaker advocated immediate construction of this dam. Mr. Davis stressed the fact that it was necessary to construct this dam on the Boulder Canyon site not only for water and power but also as a measure of flood protection to the Imperial Valley. Great satisfaction was expressed by the delegates at the heavy vote polled at the recent election in Los Angeles city in favor of the two-million-dollar bond issue for preliminary investigations of the Colorado River.

Regional Meeting of A. S. M. E. Discusses Hydro Topics

Sessions of the Pacific Coast regional meeting of the American Society of Mechanical Engineers, held at Portland, Ore., began and ended on Monday, June 22, being followed by three days of inspection trips to surrounding plants. An address of welcome by William C. Shaw, chairman of the Oregon Section, was followed by a speech from Dr. W. F. Durand, national president and chairman of the technical sessions, who dwelt on the interest evinced in the meeting by the officers of the society. Regional meetings, he said, had captured recognition as national meetings at which special attention is paid to local problems.

C. W. Morden presented a paper on the technical features of high-speed newsprint manufacture, summarizing modern practice. Another paper, by Ely C. Hutchinson, described the latest developments in high-head hydroelectric turbines, featuring the constructional details of the new Oak Grove plant of the Portland Electric Power Company and describing rubber-seal rings and the application of lubricating water, whereby effective sealing is obtained and inequalities are nullified. He also told of the success of the metallic graphite tacking shaft and described the relief valve.

At a luncheon held at the Chamber of Commerce Dr. Durand sketched the history of the society and its productive character in standardizing the products of industry, in the formulation of codes and in research. At the afternoon session James H. Polhemus presented a paper on hydraulic dredging, describing the history of the port of Portland and giving constructural details concerning the new Diesel 30-in. electric suction dredge at Clackamas. Joseph W. Gill presented a paper on steam logging, giving a historical summary of its development. Powers A. Wickes in a paper on electric logging stressed the reduced fire hazard and independence attained through water power.

A symposium on the utilization of wood waste was introduced by H. S. Bastian, comments following from H. W. Beecher and Claire C. Simeral, and papers by A. C. Sullivan and C. L. Young on the same subject were taken as read. The discussion showed keen interest in conservation and economy. The 1926 spring meeting will be held in San Francisco.

Technical Training in Europe

Director Wickenden Contrasts Methods of Foreign Nations with Those of America at Schenectady Meeting of Society for Promotion of Engineering Education

OUTSTANDING in the program of the thirty-third annual meeting of the Society for the Promotion of Engineering Education, held at Union College, Schenectady, N. Y., on June 16 to 20 and briefly reported last week, was the informal report of W. E. Wickenden, the society's director of investigations, who has for six months been pursuing researches in Great Britain and on the continent of Europe and is about to return thither for further investigation. His report was preceded by an explanatory statement from Prof. Charles F. Scott of Yale, chairman of the society's board of investigation and co-ordination, who told how plans had been formulated and the Carnegie Corporation induced to finance the investigation to the extent of $108,000 for three years.

Prof. H. P. Hammond, Brooklyn Polytechnic Institute, who is associate director of the work, advanced the following as its major purposes: (1) To clarify the educational functions and responsibilities of the colleges of engineering; (2) to establish guiding principles for the content and arrangement of curricula and the improvement of teaching; (3) to consider in what ways problems relating to engineering students, graduates and teachers may be dealt with more effectively; (4) to examine the practicability and possible benefits of closer group relationships among the colleges and with the professional organizations of engineers; (5) to make an analytical comparison of the organization and practices of engineering education in Europe and America.

After preliminary study, Professor Hammond said, it appeared that the elements to be studied were the following: (1) Engineering students, their antecedents, characteristics and preparation; (2) admission procedure; (3) teachers and methods of teaching; (4) engineering curricula; (5) engineering graduates, their careers, experiences and opinions; (6) work of the colleges in lines other than those of regular undergraduate instruction.

Important facts already disclosed by the investigation, conducted through committees, said Professor Hammond, were that the quality of preparation of entering students is seriously unsatisfactory in the essential elements of training and mental discipline, the principal deficiencies being in mathematics and English; that boys make their decisions as to their careers early in the high-school course, suggesting the need for closer co-operation between the colleges and the high schools; that numerous changes in employment are made during the first few years after graduation; that graduates urge more or better training in the principles of economics and the knowledge of business procedure, and that elimination ratios in the technical schools are higher than in some other professional schools, largely through scholastic failure.

Director Wickenden took up technical education in Europe nation by nation. In Great Britain, he said, engineering is understood to be the product of experience, schooling being supplementary. Hence technical education is modestly developed in the universities and is a rather new division of instruction. This is compensated for by extraordinary development in part-time schools for employed men and the higher development of apprentice training in industry.

In France the secondary schools are highly developed and there is an intensely competitive system for admission to the higher institutions. Thus French colleges are recruited from the elite, scholastically speaking, and they give high theoretical emphasis to their training as contrasted with practical training.

In Belgium higher technical education is given in the universities in a five-year program, the first two years being principally devoted to the general sciences and the last three professional in character. The results are substantially equal to those secured in France. In Italy the technical schools are overcrowded and making great efforts to expand facilities to meet the demand. There is a five-year program as in Belgium. The theoretical training is good, but the laboratories lack staff and equipment.

Switzerland has attracted to the professorships engineering talent of high order. In Switzerland, central Europe and Holland the schools carry the training of technical men to a point which will bring them into keen competition with British and American engineers. The aim is to produce creative technical men, not administrators, miscellaneous commercial representatives, etc. There is a strong bias toward design.

In all of these countries but Holland, and notably in Germany, there is going on a tremendous expansion in higher technical education. The enrollment in Germany has more than doubled, as compared with the total enrollment. The increase is notable in electrical, mechanical and chemical engineering, which are closely tied up with industrial development. Today there are three men being trained to one who can be absorbed in industrial Germany. The surplus will be exported as part of the German economic penetration throughout the world.

Other Convention Happenings

Valuable conferences on the place of research as an adjunct to technical training and on the relation of engineering education to industry were held during the convention. The consensus of opinion on the first question was that there are ample funds available for research but the difficulty is to find men properly fitted for the work.

One of the best sessions of the convention was that on the second topic just mentioned. Among those who took part in it were S. A. Lewisohn, of Adolph Lewisohn & Sons; Dr. Ira N. Hollis, retiring president of Worcester Polytechnic Institute; F. C. Pratt, vice-president General Electric Company, and A. I. Lipetz, consulting engineer American Locomotive Company. The last-named speaker summed up the subject by showing how co-operation between teaching and industry can be maintained, outlining a plan of engineering instruction substantially like that reported by Mr. Wickenden as in operation in Europe. The students, he said, need to be trained for independent solution of practical problems by solving problems chosen in conformity with actual conditions. Teachers should if possible be connected with the industry whose problems they teach. At the same time industry must maintain an interest in education.

Retiring President Potter's address on "The Engineering College—Its Opportunity for Service" was well received by the 350 educators present at the meeting. New officers were elected as follows: President, Dean G. B. Pegram, Columbia University; first vice-president, Dean H. V. Carpenter, State College of Washington; second vice-president, Prof. F. P. McKibben, Union College; treasurer, W. O. Wiley, John Wiley & Sons, publishers; secretary, Dean F. L. Bishop, University of Pittsburgh. Members of the council to serve for three years were also elected as follows: Dean C. H. Mitchell, University of Toronto; Major-General R. I. Rees, American Telephone & Telegraph Company; Prof. J. A. Hunter, University of Colorado; Dean B. M. Brigman, University of Louisville; Prof. W. C. Hoad, University of Michigan; Dean G. M. Braune, University of North Carolina; Prof. Clair V. Mann, Missouri School of Mines. It was announced that the 1926 meeting would be held at the University of Iowa, Iowa City.

Springfield (Mass.) Expansion Plans to Cost $4,500,000

To meet increasing load requirements over a long period of years the United Electric Light Company, Springfield, Mass., is contemplating an enlargement of its State Street steam plant from a present rating of 55,000 kw. to 95,000 kw. The estimated cost of the development is about $4,500,000, and it includes the installation of two 20,000 kw. turbo-generating units with auxiliaries and new boiler plant, the construction of a 13,200-volt switch house and provision for improved 66,000-volt interconnection facilities at the Springfield end of the Turners Falls Power & Electric Company tie line. To a representative of the ELECTRICAL WORLD L. J. Scott, manager of the Springfield company, said last week that the enlargement of the State Street station requires the purchase from the city of a section of park land immediately north of the plant and bordering the Connecticut River, the tract needed being 144 ft. long by 100 ft. wide. In case this cannot be had, the company will consider acquiring a site in the town of West Springfield for a new station on the opposite side of the river from the present location, but in view of the fact that the park on the Springfield

side is little used, lying as it does between the river and a railroad trunk line, it is hoped to add to the present plant instead of building outside the city.

Indiana Progressing in Rural Electrification Tests

Tests to determine the value of electricity on the farm have been started by specialists from the agricultural experiment station at Purdue University, Lafayette, Ind. Experiments are being tried on two farms, one near Bedford in the southern part of the state and one near Wanatah in the northern part. Co-operating with the agricultural station and research workers are the Interstate Public Service Company in the south and the Calumet Gas & Electric Company in the north. Extremes in geographical location are taken because of wide variations in the method of farming between northern and southern Indiana.

Problems affecting the electrification of fruit and poultry farms will be studied at the southern farm, where a three-thousand-tree orchard and a new eight-thousand-dollar apple storage house provide ample opportunities for the study of orchard heating, stationary spraying, artificial refrigeration and precooling of fruit. Incubation and brooding of fowls will receive attention at this farm as well as use of household equipment.

Electrification of dairy and general farms will be tried near Wanatah. Six or seven farmers of northern Indiana have entered into the plan, and in addition a large 400-acre farm owned by Purdue University will be at the committee's disposal. Problems which will receive major attention are feed grinding, milking by machine and grinding of roughage. Here, too, housework will come in for attention and many electrical labor-saving devices are to be installed.

Farm Electrification in Minnesota and Iowa

Fifty-nine companies have lent more than $14,000 worth of electrical and farm equipment for practical efficiency tests on the eight farms making up the rural electric project operated from Red Wing, Minn. Several comparative tests of the cost of gasoline and electricity for threshing grain, pumping water, husking and shredding corn and sawing wood have been made on the farms. In every case, says E. A. Stewart, the supervisor of the experiments, the cost of electricity at 3 cents per kilowatt-hour has been less than the cost of gasoline and oil used in doing the same amount of work.

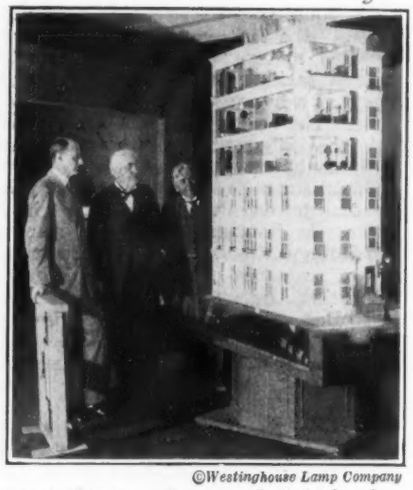
Nearly 40 miles of distribution line have been strung in carrying out the rural electrification experiments near Garner, Iowa. There are three rural lines serving sixty-three farms. Two of the lines are 6,600-volt, single-phase, while the other line is 2,300-volt, single-phase. As previously reported in the ELECTRICAL WORLD, these experiments are being carried out under the direction of the Iowa State College with Prof. Frank D. Paine in charge.

Briefer News

Kentucky Power Company Buys Carrollton Plant.—The Kentucky Power Company of Augusta, Ky., has bought the power plant and waterworks at Carrollton, Ky., and taken over the franchise for a period of twenty years. It expects to serve several communities around Carrollton as it does around Augusta.

"The Electrical Decade" on the Radio.—On Wednesday evening, July 1, between 8 and 9 o'clock, Robert M. Davis, statistical editor ELECTRICAL WORLD, will broadcast from station WOR a talk on "The Electrical Decade." As announced last week, Mr. Davis won the second prize of $1,000 in the Bonbright competition for essays reviewing the electrical industry as of the date 1930.

Edison Scrutinizes Model of Electrical Apartments.—Thomas A. Edison, accompanied by Jesse I. Straus of R. H. Macy & Company (left) and Arthur Williams, vice-president of the New York Edison Company, recently inspected the Westinghouse model apartment house at an electrical show staged by the department store. The model showed proper lighting as designed by the Westinghouse Lamp Company engineers and contained seventy exact-scale models of electrical equipment, all of which operated just as do regular-size machines. Miniature elevators ran, tiny fans created a breeze and doll-size ranges emitted heat.



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Setback to Chippewa Fall's Municipal Plans.—The plan of the city of Chippewa Falls, Wis., to acquire and operate the Northern States Power Company's electric distribution system, following an overwhelming vote in favor of the change at the election in April, received a decided setback when the State Senate killed a bill which would have permitted counties to acquire water power and electric plants. This law was intended to allow the Chippewa County Board to purchase the dam site at Chippewa Falls and erect a power plant, something the city is financially unable to do. Had the bill passed, the idea was to make the publicly owned plant a county-wide affair.

Bonbright Essay Contest.—The three essays that won first, second and third prizes respectively in the contest conducted by Bonbright & Company for the best ten-year reviews of the electric light and power industry (see ELECTRICAL WORLD for June 20, page 1358) have been printed under one cover by that company, together with the judges' report, and will be sent free to any one on application to Bonbright & Company, 25 Nassau Street, New York.

Ashe County, N. C., as a Potential Producer of Hydro-Electricity.—The County Commissioners of Ashe County, N. C., have ordered a survey of water-power sites in that county, where, they maintain, a vast amount of power is going to waste in hills and valleys. Both the South Fork and the North Fork of New River traverse the county from end to end, and at least twelve large creeks and many smaller ones could be made sources of power, the commissioners think.

Fourth Unit for Big Creek No. 1 Completed.—Installation of the fourth unit at the Big Creek No. 1 power house of the Southern California Edison Company was completed June 8, just thirty days ahead of schedule. With the addition of this 28,000 kw., Big Creek No. 1 now has a total generating capacity of 73,000 kw. The last four sections of pipe for the penstock did not arrive at the job until June 3, yet water was turned through at 8.32 a.m. June 8, and the machine was turned on the line at 5.52 p.m. the same day.

Small Plants in Middle West Absorbed.—The Illinois Power & Light Company has acquired the Mackinaw (Ill.) Electric Light Company and will continue its operation under the present name. The Dow interests of Cedar Rapids, Iowa, have acquired the Blencoe (Iowa) Electric Light & Power Company holdings, paying $60 a share for the controlling stock. The town of Colwell, Iowa, has voted to sell its municipal electric distribution system to the Northeastern Iowa Power Company. Only two dissenting votes were cast against the proposal.

Fort Wayne Residence Rate Down to 5 Cents.—The cost of electrical energy sold by the Indiana Service Corporation after July 1 to residence consumers in Fort Wayne, Ind., will be reduced from 6 cents to 5 cents a kilowatt-hour, making the city rate one of the lowest in the United States. This rate, which has just been approved by the Public Service Commission, will be matched by the municipal plant, which will put a 5-cent rate into effect on the same date. Applications by both the company and the municipal plant for permission to charge this rate have been before the commission for some time, as has been noted in these columns.

Ownership of Ottumwa (Iowa) Plant May Be Transferred.—The George M. Bechtel Bond Company of Davenport, Iowa, which owns a controlling interest in the Iowa Southern Utilities Company, operating utilities in numerous southern Iowa communities, has taken

an option on the Ottumwa (Iowa) electric plant, now owned by the Northern States Power Company. The option expires September 1 and it is expected that before that date the final transfer will be completed. C. E. Fahrney, manager of the Ottumwa properties, said that the option was granted by the Byllesby interests only because the Ottumwa plant is isolated from others of their chain and not possible to link in with the policy of interconnection. The option includes the traction system and central heating unit.

Calumet Companies to Be Combined.—Plans for the purchase of the transmission system of the Calumet Power Company by the Calumet Gas & Electric Company, as filed with the Indiana Public Service Commission, involve the transfer of the 132,000-volt line extending from the Indiana-Illinois state line to Aetna, east of Gary; of the 41,250-kw. substation at Aetna, which is the distributing center for the systems of the Calumet Gas & Electric Company and the Northern Indiana Gas & Electric Company, and of the 150-ft. right-of-way on which the transmission line is built from the the Indiana-Illinois state line to Aetna and beyond. The Calumet Gas & Electric Company intends as soon as it acquires the property to continue work on the extension of the 37-mile line to Michigan City, which will probably be completed before the end of the year. A 15,000-kw. substation will be built in Michigan City.

Utah Power & Light Welcomes Delegates en Route to San Francisco.—A large number of prominent electrical men en route to the convention of the National Electric Light Assoication in San Francisco were guests of the Utah Power & Light Company at Salt Lake City on June 13. Delegations from Idaho and Colorado and from several of the Southern states, about seventy-five in number, arrived in Salt Lake City at 8:30 a.m. They were met by representatives of the power company, under whose guidance they were taken for a tour of the city, followed by an organ recital at the Mormon Tabernacle and a luncheon at the Hotel Utah. P. M. Parry, commercial manager of the Utah Power & Light Company, presided at the luncheon. Vice-president D. C. Green of that company welcomed the guests, and vice-president Clare N. Stannard of the Public Service Company of Colorado responded. A handsome souvenir program was presented to the visitors.

First Unit at Sioux City Goes Into Commission.—The first of the two 11,250-kw. turbo-generators in the new plant of the Sioux City (Iowa) Gas & Electric Company went into commission last week, and the work of drying out and testing the second unit is under way. Construction on the plant, which now forms part of the United Gas Improvement Company system, began in May, 1924. It is designed to burn low-grade pulverized Iowa coal and can reach an ultimate rating of 67,500 kw. or more. The plant has cost in the neighborhood of $4,000,000 and will supersede two existing Sioux City plants, which, however, will be maintained for emergency service. The Sioux City plant is one of three large stations to go into service in Iowa almost simultaneously, the other two being the Davenport plant of the United Light & Power Company (described in the ELECTRICAL WORLD for April 11, page 787) and the Balls Ford plant of the Des Moines Electric Light Company, now under construction and to go into operation this year.

Irregularities in Gorge Creek Tunnel Contract Alleged.—In answer to a suit brought by R. M. Grant & Company, bond house, in the United States District Court at San Francisco to recover $177,425 from R. C. Storrie & Company, principal contractor on the Skagit River development of the city of Seattle, the contracting firm has filed counter charges alleging irregularities in connection with the awarding of the Gorge Creek tunnel contract. The bond house says that the money it seeks to recover was advanced to the contractor during the construction of the tunnel. The Storrie company charges that three bond houses doing business in Seattle virtually compelled it to enter into a conspiracy to obtain more than $2,000,000 of the utility bonds of the city of Seattle below par, contrary to law and in fraud against the city. The counter charges involve C. B. Fitzgerald, former president of the City Council, and C. F. Uhden, chief engineer for the city on the Skagit project. They are denied emphatically by all firms and persons involved. The Skagit plant was built with the proceeds of ten bond issues amounting to $11,000,000.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, January 3, page 76.]

East Central Division, N. E. L. A.—Breakers Hotel, Cedar Point, Ohio, July 14-17. D. L. Gaskill, Greenville, Ohio.

North Central Division, N. E. L. A.—Duluth, Minn., July 15-17. H. E. Young, Minneapolis General Electric Co., Minneapolis.

International Association of Municipal Electricians—Hotel Statler, Detroit, Aug. 17-20. W. R. Arbuckle, Bayonne, N. J.

Wisconsin Utilities Association, Electric Section—Green Bay, Wis., Sept. 4-5.

Camp Co-operation V (local leagues)—Association Island, Henderson Harbor, N. Y., Sept. 8-12. (Society for Electrical Development, New York, is sponsor.)

New England Division, N. E. L. A.—Hotel Griswold, New London, Conn., Sept. 8-11. Miss O. A. Bursiel, 149 Tremont St., Boston.

Pennsylvania State Association of Electrical Contractors and Dealers—Hotel Jermyn, Scranton, Sept. 10. M. G. Sellers, 1202 Locust St., Philadelphia.

Rocky Mountain Division, N. E. L. A.—Hotel Colorado, Glenwood Springs, Col., Sept. 14-17. O. A. Weller, 900 15th St., Denver.

Southeastern Geographic Division, N. E. L. A.—Birmingham, Sept. 15-18. E. T. O'Connell, Alabama Power Co., Birmingham.

Great Lakes Geographic Division, N. E. L. A.—French Lick Springs, Ind., Sept. 23-26. R. V. Prather, 305 Illinois Mine Workers' Bldg., Springfield, Ill.

Association of Electragists International—West Baden, Ind., Sept. 23-25. L. W. Davis, 15 W. 37th St., New York.

American Electrochemical Society—Chattanooga, Tenn., Sept. 24-26. Colin G. Fink, Columbia University, New York.

St. Louis Companies in Litigation Over Electrical Contracts.—Motions for a new trial and arrest of judgment of a decision last December by a jury in the Circuit Court in St. Louis awarding the Wiles-Chapman Lumber Company $33,920 damages against the Union Electric Light & Power Company and the North American Company for alleged diversion of certain electrical contracts from the Laclede Gas Light Company through a financial arrangement with an employee of the latter company were overruled on June 8. Attorneys for the defense announced that an appeal to the Missouri Supreme Court will be taken. The suit was the first of five similar actions filed against the Union company by St. Louis consumers of electricity. The total amount of the suits is $116,000.

Southern Sierras Power Company Signs Large Contract.—The Southern Sierras Power Company has contracted to furnish power to operate pumping plants for a new irrigation district in lower California being opened by the Delta Canal Company of Calexico. The known territory in which underground water may be pumped in sufficient quantity for irrigation purposes covers an area 20 miles long, ranging in width from 3 miles to 6 miles. Approximately 200,000 acres of cotton-growing land for which gravity water from the Colorado River cannot be used will be made available through this development. Comparative costs of central-station service with Diesel-engine power were carefully analyzed, and, though it is necessary to transmit the power a distance of more than 500 miles from generating plants in Inyo and Mono Counties, the former was decided upon as the more efficient and economical.

Automatic Hydro-Electric Plants for New York State.—Two automatic hydro-electric installations of large size will soon add more than 25,000 hp. to the transmission lines of New York State. The larger of these is to be built at the Soft Maple development of the Northern New York Utilities on the Beaver River (described in the ELECTRICAL WORLD for April 25, page 891) and will produce 21,000 hp. It will have two 10,500-hp. generators and will be controlled from Taylorville, 15 miles distant. The entire equipment of the plant is automatic and will be started and stopped by energizing and de-energizing the transmission line. The second automatic plant is to be built near Potsdam by the St. Lawrence Valley Power Corporation and will consist of two 3,200-hp. generators. On the Deerfield River in Vermont a 6,500-hp. automatic hydro-electric plant has operated so satisfactorily that its performance has led to the construction of the two New York plants, and it is predicted by engineers that even larger automatic stations will be developed within the next few years.

Men of the Industry

J. E. Davidson New N. E. L. A. President

James E. Davidson, vice-president and general manager of the Nebraska Power Company, Omaha, was elected president of the National Electric Light Association at the convention last week in San Francisco. The election of Mr. Davidson to this highest position in the electrical industry recalls his beginning in the light and power business at a small plant in Port Huron, Mich., where as a boy he worked as oil wiper, coal heaver and meter reader. He rose rapidly and became superintendent of this plant when he was twenty years old. He left Port Huron for Montpelier, Vt., in 1905 to become general manager of the

J. E. DAVIDSON

Consolidated Lighting Company, where he directed the purchase of the competing plant in Montpelier by his company.

In the latter part of 1910 Mr. Davidson went to Portland, Ore., as general manager of the Pacific Power & Light Company, this connection marking the beginning of his affiliation with the Electric Bond & Share Company, with which he has been associated ever since. In 1912, at the age of thirty-one, he was made vice-president and general manager of the Pacific company. Mr. Davidson went to Omaha in 1917, when he was made vice-president and general manager of the Nebraska Power Company.

Ever since he became an employee of the Port Huron plant he has taken an active part in the electrical industry, and he has contributed many valuable, technical articles to electric light and power magazines. He has always taken a keen interest in electric light associations and served as an officer in branches of the N. E. L. A. wherever he resided. While at Port Huron he was elected secretary of the Michigan Electric Light Association. In 1908 he was elected president of the Vermont Electrical Association, and in 1910, the year in which he left Vermont, he was elected president of the New England Section of the National Electric Light Association, resigning when he left for Oregon.

While at Portland Mr. Davidson brought about the adhesion of the Northwestern Section of the Electric Light and Power Association to the National Electric Light Association. He was elected president of the Northwestern Section in 1912. On his arrival in Omaha he resumed his interest in electric light and power activities and was elected president of the Nebraska Section in 1918. Last year he served as chairman of the Lighting Educational Committee, which sponsored and directed the international "better home-lighting" campaign and essay contest in the United States and Canada.

Mr. Davidson was born at Flint, Mich., on November 10, 1879. His father, Wilbur F. Davidson, was one of the pioneers of the electric light and power industry. Besides being vice-president and general manager of the Nebraska Power Company, he is a director of the Chicago Great Western Railroad and the Live Stock National Bank and is also a member of the board of directors of the University of Omaha.

W. L. Percey Advanced to Vice-Presidency in Los Angeles

At a meeting of the board of directors of the Southern California Edison Company held Friday, June 12, **W. L. Percey**, formerly treasurer, was elected vice-president in charge of corporate contracts and documents, **Roy V. Reppy**, general counsel, was elected vice-president and general counsel, in charge of legal matters, and **Edgar G. Miller**, who has been acting treasurer, was elected treasurer. These changes in the organization were made necessary by the increasing pressure upon the executive heads of all departments which has followed the great improvement in business conditions.

Mr. Percey is one of the original group of men who made up the executive force of the company. He joined the West Side Lighting Company, one of the predecessor companies of the present Edison company, in 1898. Beginning as cashier, step by step he worked up through the ranks until in 1906 he was made treasurer of the company, which position he has held up to the present time.

Mr. Miller, the new treasurer, has made a rapid rise in the public utility world. Less than ten years ago he joined the Southern California Edison Company in the accounting department. Subsequently he went to the insurance department and then to the secretary's office as assistant secretary. His grasp of financial problems paved the way to his appointment as acting treasurer early in 1925.

Mr. Reppy joined the company in 1919 as general counsel. He was graduated from Harvard Law School in 1905 and was admitted to the California bar the same year in San Francisco. In 1914 he became assistant county counsel in Los Angeles County, leaving this position in 1917 to become a member of the law firm of O'Melveny, Millikin, Tuller & McNeill. Two years later he severed his connection with this law firm to affiliate himself with the Southern California Edison Company.

Sperry and Insull Honored by Northwestern University

Elmer Ambrose Sperry, engineer-inventor and president of the Sperry Gyroscope Company, and Samuel Insull, president of the Commonwealth Edison Company of Chicago, were awarded honorary degrees by Northwestern University at its sixty-seventh annual commencement on June 15. The degree of doctor of science was conferred upon Mr. Sperry and that of doctor of laws upon Mr. Insull.

A prolific inventor and the holder of more than four hundred patents on

E. A. SPERRY

mechanical and electrical devices, Mr. Sperry has long been an outstanding figure in the electrical industry, having been one of the founders of the American Institute of Electrical Engineers and of the American Electrochemical Society and chairman of the committee that called the first meeting of the National Electric Light Association. In presenting Mr. Sperry, Dr. William Charles Bauer, director of the engineering department of Northwestern University, said: "An electrical engineer and a physicist who has shown remarkable skill in applying scientific methods and knowledge to the solution of practical problems; inventor of the Sperry gyro-compass, of many valuable aëronautic instruments, of the highest power searchlight, and of fire-control apparatus for the United States Navy; a pioneer electrical manufacturer in America, and a founder member of the Society of the American Institute of Electrical Engineers."

Ralph Emerson Heilman, dean of the department of commerce, in presenting Mr. Insull paid the following tribute: "Pioneer in public utility development, president and moving spirit of the Chicago Civic Opera Company, trustee of St. Luke's Hospital and active worker in its behalf, chairman of the Illinois State Council of Defense, patron of music, humanitarian and public-spirited citizen, a leader in civic and industrial progress."

Heman Ely, vice-president and treasurer of the Timken Roller Bearing Company, Canton, Ohio, has retired from active connection with the company after an association of sixteen years. Mr. Ely entered the services of the Timken company in 1909 as secretary, and in 1916 he was also appointed treasurer. He became vice-president and treasurer in 1920. Beyond the statement that he will take a short vacation, Mr. Ely announced no plans for the future. **H. J. Porter**, who has been general sales manager, is advanced to vice-president in charge of sales. **L. M. Klinedinst**, heretofore assistant to Mr. Porter, becomes general sales manager of the industrial division.

V. D. Armstrong has recently been appointed distribution engineer of the Puget Sound Power & Light Company, Seattle, Wash.

Cyrus Eaton of Cleveland has been elected president of the Columbus Railway, Power & Light Company, succeeding Charles L. Kurtz, resigned.

Owen D. Young, chairman of the board of directors of the General Electric Company, has during the present month been awarded the honorary degree of doctor of laws by three universities—Yale, Columbia and Colgate.

John W. Howell of the Edison Lamp Works was awarded the degree of doctor of science last Saturday by Rutgers College. Mr. Howell was the recipient of the Edison medal last February.

H. D. Randall, manager of the Rocky Mountain district of the General Electric Company, with headquarters in Denver, has been transferred to an executive position in the industrial department of the company at Schenectady. At present he is recuperating from a long illness at Groton, Conn.

W. J. Dennis, for the past year assistant to the general manager of the Northwestern Electric Company, Portland, Ore., was recently appointed assistant general manager of the company. Mr. Dennis was born in Houston, Tex., in 1881 and made his entry into the public utility field in 1912 in the sales department of what was then the Portland Railway, Light & Power Company, remaining about a year. When the Northwestern Electric Company commenced operations in the city in 1913, Mr. Dennis joined the sales department of that company, remaining in this work until 1924, when he was made assistant to the general manager.

Charles I. Crippen, who had been district manager at Youngstown, Ohio, for the engineering firm of Dwight P. Robinson & Company, Inc., has recently been appointed assistant to the general manager of the Penn-Ohio system. Mr. Crippen is widely known in the Middle West, having been identified for many years with local engineering and electrical interests. Previous to his association with Dwight P. Robinson he was for two years a member of the firm of Crippen & Funk, with offices in Youngstown. His earlier connections include the National Tube Company, the Corry Pail Company, the Mahoning & Shenango Railway & Light Company and the West Penn Power Company.

F. V. Underwood General Manager in Knoxville

Fred V. Underwood, for many years associated with electrical interests in Alabama, has just been appointed general manager of the Knoxville Power & Light Company, Knoxville, Tenn. Mr. Underwood entered the public utility field in 1900 in the employ of the Consolidated Electric Light Company of Birmingham. This company later became part of the Birmingham Railway, Light & Power Company, now the Birmingham Electric Company. He continued with the Birmingham properties through their reorganizations to the present time. A practical operating man, he has worked his way through various positions with the Birmingham company to be assistant general manager.

During the World War Mr. Underwood was for a short time connected with the Alabama Power Company as superintendent of production, having

F. V. UNDERWOOD

charge of its generating plants, both hydro-electric and steam. His principal attention, however, was given to the operation of the Gorgas plant, where construction work was rushed in order to furnish power for nitrate plants at Muscle Shoals. About the time that work was completed Mr. Underwood returned to the Birmingham company.

Frank B. Jewett, vice-president of the American Telephone & Telegraph Company, was awarded the honorary degree of doctor of science by Dartmouth College at the commencement exercises held on June 23. A few weeks ago Dr. Jewett was awarded the same degree by New York University.

D. U. Hartman, who has been connected with the Indiana Power Company since 1920, has been promoted to the office of general manager. The company was recently taken over by the Interstate Public Service Company and prior to the acquisition Mr. Hartman was acting manager. He is a mechanical as well as an electrical engineer.

William S. Hart, who has been prominently connected with Canadian electrical interests for many years, was elected president of the Canadian Electric Railway Association at its recent meeting in Montreal. Mr. Hart is treasurer and director of the Shawinigan Water & Power Company, treasurer and director of the Canada Carbide Company, Ltd., vice-president, treasurer and director of the Canadian Electro Products Company, Ltd., vice-president and director of the Continental Heat & Light Company, president and director of the Electric Service Corporation, vice-president and director of the North Shore Power Company, treasurer and director of the Quebec Power Company, treasurer and director of the Quebec Railway, Light, Heat & Power Company, Ltd., vice-president and director of the Shawinigan Engineering Company, Ltd., and treasurer and director of the St. Maurice Power Company, Ltd. A native of Foxboro, Mass, and a graduate of the Massachusetts Institute of Technology, Mr. Hart went to Canada from the United States in 1903.

George M. Moore, assistant secretary of the United Electric Light & Power Company, New York, since 1919, has been appointed treasurer of the company to succeed Lawrence A. Coleman, who was recently elected vice-president of the New York & Queens Electric Light & Power Company. Mr. Moore has been in the employ of the United since 1892, having served as assistant to the general bookkeeper, accountant, chief accountant and auditor.

Obituary

William Mainland, president of the Hannibal (Mo.) Railway & Electric Company, died June 3 at his home in Oak Park, Ill. Mr. Mainland was sixty-six years of age.

Walter C. Rossman, local manager of the Consumers Power Company at Grand Ledge, Mich., died in Lansing May 3 as the result of an operation. Mr. Rossman had been affiliated with the Consumers Power Company for the past eleven years.

Dr. Ing. Carl Gaa of Mannheim, Germany, one of the directors of the Brown-Boveri Company, recently died in his fifty-fourth year. In 1893, when he was only twenty-two years of age, Dr. Gaa was intrusted with the building of the municipal electric light station in Frankfort-on-the-Main.

Clifton H. Wheeler, vice-president and general manager of the C. H. Wheeler Manufacturing Company of Philadelphia until two years ago, when he suffered a stroke, died May 29. In 1891 Mr. Wheeler organized the Wheeler Condenser & Engineering Company for the manufacture of surface condensers, serving as president and general manager until 1904. With the advent of the steam turbine came the demand for higher vacuum, and Mr. Wheeler secured the American rights for the Edwards air pump and in 1905 started building up the present company to improve and develop new types of condensers for higher vacuum. Later, therefore, he was able to assist in the introduction of the successful steam air ejector in American power plants. Mr. Wheeler was a member of the American Society of Mechanical Engineers, the Manufacturers' Club, the Machinery Club and other industrial organizations.

Commission Rulings

Company Required to Repair Transformers Owned by Consumers.—Complaints were made before the Missouri Public Service Commission against the Rothville-Sumner Electric Company by citizens of Sumner who are served by the company's transmission line. The complaints alleged poor service and high rates to the rural customers. The commission found that the rates were not excessive but also found that there had been much trouble with transformers owned by the customers, the trouble being due to lightning. It therefore directed that the company be required to repair customers' transformers on request and to provide a spare step-down transformer where the company's transmission line connects with the lines of another company from which it purchases power.

Company and Customers Directed to Share Expense of Extensions.—The Missouri Public Service Commission directed the Owensville Electric Light Plant to make extensions of 100 ft. or less to new customers at its own expense, but authorized the company to collect 10 cents for each additional foot. The commission further directed the company to furnish service on Sunday, but, in a dispute between the city authorities and the company over the cost of all-night service, sustained the company, holding that the city would have to pay very nearly the price asked for all-night street-lighting service to replace the part-time service then in effect.

Permission Granted to Utility to Operate in Territory Without Making Unprofitable Extensions.—In granting permission to J. B. Manley to operate an electric utility in the town of Candia, the New Hampshire Public Service Commission overruled the protests of a few individuals who wanted service but whom Manley refused to serve unless they paid for the extensions to their property. These protestants were locally prominent and had believed they would have service without having to contribute to construction costs, but the commission approved Manley's statement that the income derivable would not justify the expense of connection unless higher rates than would otherwise be sufficient were charged all consumers. The commission based its decision on the principle that the public welfare should be considered rather than the claims of individuals.

Rates in New Community Should Not Throttle Development.—The Arizona Corporation Commission in considering a complaint against I. A. Van Dyke and C. W. Van Dyke, who operate the electric, telephone, gas and water utilities in the mining town of Miami, found that the rates were excessive and not regulated to encourage the greater use of electricity and that the proprietors were averse to extending their service. The utilities were an adjunct to a real-estate development company, though in no other way connected with it, and had simply grown as the town, which is near large copper mines, had grown. No effort had been made to keep the utilities ahead of the town's growth, and the proprietors, the commission found, had even refused to extend profitable service outside of the city limits. The commission also found that some of the real-estate valuations, owing to appreciation, were too high for valuation purposes. The rates were lowered and a schedule was established which would encourage greater use of power at all times and thus bring up the low load factor under which the company had been operating. The proprietors contended that rates of all the utilities should be considered together, since the telephone, gas and water departments were not profitable, but the commission ruled that since the complaint mentioned electric rates only, they alone could be considered.

Proposed Rural Service Rates Disapproved in Missouri.—The Missouri Public Service Commission disapproved proposed rates of the Missouri Power & Light Company for rural service because the commission believed that the method by which the proposed rates were to be computed was not fair to the rural consumers. It was proposed that the rural electric rate should consist of the urban rate applicable in the municipality from which service was rendered, together with an excess cost charge which would be 7 per cent annually of the connection charge divided into twelve equal monthly installments in cases where the consumer assumed the burden of replacing the line, plus the monthly cost of energy lost in the transformers, or 11 per cent annually of the connection charge, divided into twelve equal monthly installments in cases where the company assumed the burden of replacing the line, plus the monthly cost of energy lost in the transformers. The commission said that it appeared logical to adopt as a basis the rate in effect for similar service at the point of origin and to add thereto the excess cost of rendering service to the rural consumer and that such a rate schedule should be equitable to all classes of consumers and to the utility. However, the commission said: "If two municipalities having different electric rates are interconnected by a transmission line, what base rate is applicable to rural consumers served by an extension from the transmission line? The alternative plan of a 7 per cent charge should be eliminated from the rates and rules applicable in cases where consumers desire rural electric service as individuals in order to avoid confusion, disputes and complaints. The urban rate covers urban transformer losses. Hence, if the urban rate is adopted as the base rate for rural service, the rural consumer will be required to bear both urban and local transformer losses. The average transformer loss per consumer per month should be ascertained for the locality in which the base rate is adopted, and this transformer loss should appear as a credit in rural consumer's bill."

Recent Court Decisions

Right-of-Way in Alabama Does Not Include Right to Build Fences.—In the case of the Alabama Power Company vs. Sides the Supreme Court of Alabama again emphasized one of its former decisions, that the company did not acquire the right, when condemning land for transmission-line right-of-way, to fence this land in and thus divide the original owner's property. The court also held that evidence of a price paid by the company to another owner in condemnation proceedings was not competent, since condemnation proceedings are always in the nature of a compromise. (103 So. 859.)*

Accident Caused by Wire Fallen in Street Is Evidence of Negligence.—In the case of Williams vs. City of Canton the Supreme Court of Mississippi declared that if any wire carrying electricity was on the ground where it would cause injury, this constituted evidence of negligence on the part of the corporation, either private or municipal, which owned the line. The suit was brought against the city of Canton, which operates the electric utility, because of the death of a negro boy ten years of age. The lower courts found in favor of the city because, while the plaintiff claimed that the wire had been broken down by employees of the city felling a tree, the city produced witnesses to show that its employees had not broken the wire down. The Supreme Court, however, stated that any company transmitting electricity along a highway must exercise the utmost care and that the mere fact that the wire was down and that no precautions had been taken to prevent injury to people on the street showed negligence on the part of the city. (103 So. 811.)

Favorable Power Contract Should Be Considered of Value in Fixing Rates.—The United States District Court of Minnesota, Third Division, in reviewing a master's report on the case of the Duluth Street Railway Company vs. Railroad and Warehouse Commission of Minnesota, allowed the company's claim of value to be attached to a contract which it held to purchase power at favorable terms. The master, in making a report on an injunction suit brought by the company against the commission to prevent the lowering of rates, took evidence as to the valuation of the company's properties to determine whether the valuation and rates were confiscatory. In his report to the court he did not allow the company's claim of the value of the power contract, but the court has overruled him, saying: "The contract was a thing of value, and it differed from an ordinary contract for current supplies. It took the place of a physical plant which would otherwise have been necessary and would have been valued as a part of the physical items." (4 Fed. (2d) 543.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Manufacturing and Markets

Power Club Activities

Appropriate Committees Will Probably Study Possibilities Opened Up by Trade Association Decisions

BY ALFRED E. WALLER
President Electric Power Club

THE Supreme Court has by its recent decisions relating to trade association activities dispelled an atmosphere of uncertainty which has long been a disturbing factor in business. The principal decision contains a number of statements any of which would justify development into a treatise, or, if carried out by appropriate action, would supply the direction for a great deal of effort. It is not possible at this time to predict in what manner these decisions will affect the activities of the Electric Power Club. All public policies are initiated by the membership, and there have been no meetings since the decisions were published. Undoubtedly the possibilities will be studied by appropriate committees, and it is to be expected that constructive utilization of the new privileges will follow in due course.

Among the principles set forth perhaps none is of greater interest than the following: "It was not the purpose of the Sherman anti-trust law to inhibit the intelligent conduct of business operations—for the simple reason that the Sherman law neither repeals economic laws nor prohibits the gathering and dissemination of information." This is what business men have believed should be the intent, but their faith has been rudely shaken in the past. After the enactment of a law comes its interpretation by the courts, and it is often difficult for the lay mind to justify the conclusions reached.

The members of trade associations and those responsible for their direction have hesitated to carry on many constructive activities for fear that these might be construed as restrictive and illegal. Associate Justice Stone, who delivered the opinion, felt the need for a clarification of these matters while he was Attorney-General. At that time he recognized that most trade associations are operating along lines which are entirely lawful and of inestimable benefit to the public. Others, in his own words, "are groping in the twilight zone of illegality; a few are wholly illegal." The present decision shows that most of the activities which had been popularly considered to be in the "twilight zone" are in fact useful and constructive.

NEW POSSIBILITIES OPENED

Fundamentally, the value of any business or of any business association is measured by its contribution to the general welfare. Benefits of this nature accrue alike to that portion of the public which is served by an industry and to the portion which is employed by it directly and indirectly. The value of a trade association to its industry lies in its ability to standardize, to stabilize and to eliminate the ruinous effects of unfair competition. A united industry can speak and act with authority regarding matters within its scope. Trade associations which until the present have confined their activities chiefly to joint publicity, codes and technical standardization now have several new possibilities open for consideration. They may aid their member bodies, and through them the public, by the collection and dissemination of data relating to production, stocks, unfilled orders, specific job contracts and average sales prices.

It is affirmed that competition does not become less free merely because the conduct of commercial operations is made more intelligent through the free distribution of all essential factors entering into the commercial transaction. Again quoting from the decision: "Restraint upon free competition begins when improper use is made of that information through any concerted action which operates to restrain the freedom of action of those who buy and sell." These are heartening words. They say, in effect, that trade association activities are to be judged by their results, and not by what some one may conceive to be their ultimate purpose.

RESPONSIBILITY OF ASSOCIATIONS

Somewhere between total disorganization and restrictive control there is in any industry a field for constructive effort. It is the duty of trade organizations to strive for the utmost development within the boundaries of legality as these are defined by interpretations of the Sherman act. The present removal of restrictions which date back to the administrations of Presidents Roosevelt, Taft and Wilson is an admission that they were not justifiable and necessary in the light of experience. It is for business to prove that even a greater range of activities is compatible with public welfare. Great responsibility is placed upon trade organizations, since it is largely by their conduct that the wisdom of allowing greater freedom will be judged.

Liberality in Buying Machinery*

Specialized Equipment Cannot Be Purchased on the Same Basis as Standard Apparatus—Industry Producing It Cannot Survive Under Ruthless Competitive System

BY H. BIRCHARD TAYLOR
Vice-President William Cramp & Sons Ship & Engine Building Company, Philadelphia

THE advances in the public utility field which have made possible the greater service and reduced cost include improvement in methods of management and administration, in construction of plants, power lines and distributing systems and in power-producing machinery and equipment. It is essential for general progress that each of these elements shall continue to undergo improvement. Under the existing situation of the utility companies they can and do promote improvement of those elements for which they are directly responsible; but in the elements comprising highly specialized machinery and equipment which is purchased I feel that the management and engineering forces of the company do not generally show due appreciation of certain important aspects of the situation. Just as our general education fails to provide a basis for popular appreciation of engineering or scientific achievements, perhaps some of our engineers and managers in the utility field themselves lack due appreciation of the specialized engineering and design demanded in the building of power machinery, or perhaps the manufacturers are to blame for furnishing engineering service for nothing. The situation in the machinery business is the direct result of a *reductio ad absurdum* of the competitive system.

The service rendered by our utilities is the sum total of the contributions to applied science from all the elements which make the service possible. Much credit for the present efficient service belongs to the designers and manufacturers of special equipment—electrical, steam and hydraulic. Hundreds of scientists and engineers are employed by the manufacturers in developing new types of power-producing apparatus and improvements in design, to the end that such apparatus shall be more efficient, more reliable and have longer life.

Although it is recognized that special machinery must be purchased on a competitive basis, it must be borne in mind that the industry producing it cannot survive under a ruthless competitive system and that the purchaser should deviate from the methods he uses in purchasing raw materials and standard equipment in order that more liberal treatment may be accorded those who are continually contributing to the advance of the art.

A PLEA FOR A BROAD VIEWPOINT

I have advanced the view that general education under modern conditions should be made more truly liberal. In

*From an address made before the annual convention of the National Electric Light Association held in San Francisco, June 15-19, 1925.

considering the engineering and management of our public utilities I would urge upon the men who are responsible for future progress in this field that they also should cultivate the broad view of our modern civilization, and in the expansion of the industry that they should keep constantly in mind the human relations and the purpose of the industry, which should be to render service. I believe the industry is already distinguished by the degree in which these factors are now observed, but our efforts should be enlarged.

I would also remind you of the great influence which the human factor exerts even upon the carrying out of physical construction and design. Reverting to the hydro-electric field and reviewing the more notable engineering works which have been carried out in this field in America, many of which deserve to stand as monuments to the men and organizations that have created them. I think you will recognize the vital influence of the human factor in these accomplishments. I have been greatly impressed by the extent to which the vision and personality of some one man or group of men have made possible the creation of our many great works of engineering and construction.

While I believe that the greater number of our power companies and utilities exemplify in the management and engineering the influence of personality, adherence to ideals and a broad vision of the future in the shaping of their policies and the carrying out of projects, I nevertheless believe that there are at the present time two different types of organization intrusted with the building of developments in this field. One is the type of organization which directs its main efforts to attaining minimum first cost, which awards all contracts on the basis of competitive bids, endeavoring to rely on specifications for obtaining equipment of the desired grade, and which leaves the final purchase of important engineering equipment, particularly of the great units, to routine handling. With the other type it is characteristic to handle many of the special engineering features purely as a routine matter; that is, the organization is one in which the human element is but little in evidence and the work of which is not handicapped in any way by sentiment. It is characterized by the total absence of any tendency to attempt the unusual. This type of organization is of the sort which when purchasing machinery involving great specialization of engineering and the solution of technical problems of the first order will place almost sole reliance in the choice of equipment upon competition, with first cost obscuring all of the intangible elements, and in fact will endeavor to buy such engineering work by the ton, as it would buy pig iron, and will not give it at all the sort of consideration which an executive would exercise in buying a house or an automobile for his personal use.

The other type of organization is exemplified by many of our leading power companies and consulting engineers and is one which frequently has an outstanding personality in charge of its work, either some one man or a number of men working with common aims. The type of organization which I now have in mind is one which encourages initiative and imagination, which is willing to appropriate money to encourage engineering innovations that appear to have promise, which in awarding contracts places emphasis on questions other than that of price alone and keeps in view such considerations as the general progress of engineering and the possibility of future improvements beyond the immediate project in hand. Real progress has come from this second type of organization. The contact of such an organization with engineers and manufacturers is inspirational in character, and the intangible benefits that ensue far outweigh the factors whose value can be definitely assessed.

I would urge that in your management and engineering work you keep in mind the greater relationships and that in the handling of the physical problems of engineering you keep in view the importance of the spirit which animates the work.

Wiring Code National Standardization*

Local Codes a Serious Handicap to the Industry—Often Dictated from a One-Sided Viewpoint—Handling of Necessary Local Rules Discussed

BY W. J. CANADA
Electrical Field Secretary
National Fire Protection Association

STANDARDIZATION of interior electrical construction practice has long been understood to be a practical necessity. Such practice is highly repetitive both from installation to installation and from community to community. From the early condition of no rules of practice, when each installation was an experiment, we proceeded to a rule of practice for each community and then, rather slowly but surely, to a correlation of these varying rules of different communities into one set agreed upon as suitable for widespread use. More than thirty years ago a National Electrical Code became an accomplished fact. From the very beginning we had democratic procedure in the formulation and revision of our national code of electrical rules. Each organization previously having a set of rules contributed ideas and joined in supporting a single set. Previously there were four principal sets of rules and many minor ones. The condition was unbearable, even in those days of simple electrical practices. Today with increasing applications a single set of rules is even more evidently a necessity.

Next we developed a continuing machinery for code production and dissemination, which now, after thirty years of development, approaches the ideal. There is in the code making of today no lack of consideration for economy, convenience, safety or applicability to varying physical situations. There is in the code-making machinery a strong resistance to special pleadings of all kinds. The electrical code for interior wiring is, in these respects, a really trustworthy standard. No matter how good a product is, however, it must be marketed widely for best results, and this is especially true of the code.

UNIFORMITY UPSET BY LOCAL RULES

In the National Electrical Code we have a standard product, but its natural market, including every inspection jurisdiction, is today partly occupied by local products. Now, these local codes add seriously to the costs of producing, storing, shipping, delivering, installing and using electrical wires and appliances. Every one concerned loses by these added costs. They profit nobody except as they furnish an artificial field for some peculiar product or for the exploiting of some peculiar idea. Yet in the past few days I have been studying two cases where manufacturers desired changes from code wording and were working for them in local rules to supplement patent protection in promoting their patented devices.

It is true that were all local special rules today wiped out by some marvelous sudden change in local human nature by which it could put aside personal commitments, personal errors of judgment and personal pride in those errors simplification would not be complete. We should still find a field for further useful simplification in reducing the needless variety still allowed for by our present national code itself. Local tendencies to variations and local reluctances to abate variations are unfortunately sometimes fostered by selfish non-local interests.

Evidently a real study of this local near-standard disease and the means of effecting the national real standard cure is worth some considered and concerted effort. So have thought for some years those several organizations which have finally evolved the idea of an electrical field secretary with the duty of investigating this disease and ascertaining means for effecting the cure. The electrical industry is unitedly expressing its support of such an effort toward eliminating a large waste in our industry.

Code making is clearly a type of legislative function, whether carried on by governmental bodies or simply carried on co-operatively by associations. Code administration, on the other hand, is a function having nothing inherently to do with code making and is better, stronger, fairer, less easily misled or misjudged or attacked if the administrators are not tempted into undertaking to make rules, but confine their work to administering the code. The legislative function is best handled by representative bodies, which tend to act with sufficient deliberation to consider

*From an address before the meeting of the Electrical Supply Jobbers' Association, Hot Springs, Va., June 3-5, 1925.

every point of view. On the other hand, the administrative function is best handled by individuals, who tend to act promptly and to get the daily work of the world done without the delays which many minds unavoidably introduce.

If the national standard is not adequate in all respects and in every part for local administrative purposes, it will, of course, in an orderly manner be modified to bring it as nearly as practicable to a state of adequacy from the administrative standpoint. Real adequacy must be such as will successfully meet commercial, competitive and interpretative necessities. Leaving too much to the imagination of the code applier is not wise. Fortunately, many municipal and inspection jurisdictions are today administering with success and general satisfaction the National Electrical Code unchanged, whereas it is in those jurisdictions where local standardizing ventures have been most numerous and least recognized by their progenitors as being ventures that the greatest administrative difficulties have arisen and the greatest embarrassments to industry and to the public have been experienced.

Local Codes Hinder Simplicity

There is little doubt that in future with less time lost in trying to prepare and revise local rules separately, certain problems in the national code itself can and will receive more prompt and adequate attention than heretofore. One such problem concerns closer limitations on the permissible number of types of interior wiring installations. Progress toward simplicity through limitation of the number of allowable types of wiring may be better achieved by national than by separate local standards, and the general solution of the problem may be found to be related more properly to differences in building construction and character of occupancy than to differences between fire districts or to differences between entire cities.

One serious line of local divergences comes in determining the size of motor feeds, building feeds, etc., according to locally different theories, preconceptions and precommitments. Many more examples of local differences might be given. Sometimes an apparently minor change in some one or more cities may embarrass manufacturers, jobbers, electragists and inspection agencies themselves in these or other cities to a serious degree. Worst of all is the tendency to lose sight of the fact that such local rules should be at least as progressive as the national code—which is sometimes deemed conservative enough. But they are not usually so progressive; I can point to some of twenty years' standing. Sometimes a local rule for which reasons were once rather good is maintained long after all reason has departed.

How to Handle Local Rules

Observation and discussion lead to the question whether any locally varying rules now existing or later thought necessary for peculiar local conditions should not be carefully segregated from the adopted code, which could best be the national code unchanged. The national code perhaps could be on file and could comprise the entire body of rules adopted by the local ordinance and administered by the administrative agency, the inspector, as also arranged for by the ordinance.

An entirely separate set of rules, preferably few and brief, and more properly called temporary conventions or current administrative requirements, could where necessary be set up to supplement the adopted National Electrical Code—provision being made by the ordinance for power to adopt such temporary and supplementary rules, perhaps vested in some thoroughly representative local body—since this is more of a legislative function than an administrative one. The idea of separation of any such special rules from the code and from the ordinance cannot, in the judgment of many conferees, be too strongly stressed. Thus they may be examined from time to time to test their continuing validity and dropped when circumstances permit. Thus, also, they may, where they show worth and vitality, be easily seen and readily appraised by national committees, association and joint conferences and incorporated as found desirable in the national code itself.

In particular, it appears to many conferees to be the part of wisdom to avoid by all means writing local special rules into the ordinance itself. Ordinances are naturally subject to less regular review than is the national code or than should be any separate special rules. The ordinance essentially would be only the authorization and empowering of the administration of a suitable standard. The idea of a typical administrative ordinance is gaining much attention today.

Thus taking the world as we find it, and electrical ordinances, the national codes and local special rules as we find them, we may hope, by keeping these three documents separate and maintaining their separation, to insure in the future a progressively more widespread use of the ordinance as a purely empowering document—the National Electrical Code as the recognized standard for interior wiring, adopted and followed by all communities, and special rules for less numerous, less serious problems, so isolated that all of us can see them, appraise them and properly handle them. History and habit in individual communities will sometimes prevent the desirable segregation of ordinance, code and rules at one step. Even where separated, the abatement of existing variations from the national code cannot always be so quickly accomplished. But if the end is clearly seen and if it is agreed to be desirable, progress toward the end is certain.

Business Conditions

ACTIVITY of industrial plants in the purchase of electrical equipment is prominent in the business conditions reported from many sections of the country. Many orders have been received from these sources, and present inquiries from many types of industries include a large amount of equipment. A large manufacturer reports that during the month of May the tonnage produced in his factory was the largest in its history, but low prices prevented the value of the products from attaining a correspondingly high level. It is known that the same condition applies to several other companies.

The prices of the more competitive sizes of rubber-covered wire have at last followed the increase in the price of rubber. Increases of 5 per cent to 10 per cent have been announced, and as rubber continues to strengthen further price changes are anticipated. The larger sizes of rubber-covered wire have long since followed the rise in rubber. Sales of motors to electrical refrigerator manufacturers are quite active. A good volume of buying is reported in the steel industry, with shipments about 70 per cent of plant capacity. There is no indication that consumption will decrease materially, if at all.

In New England the demand for industrial equipment has been very active and many sales of general-purpose motors are recorded. Electric industrial heating maintains an encouraging activity in that territory, and many inquiries are reported from the tool-making and machinery industries. Buying of supplies by central-station companies in the New York district continues in steady volume. Several sales to industrial plants have been made in that district, and many inquiries presage good future business from that source as well as from municipal projects. In the Southeast an improvement is noted in the business outlook, building construction is active, and the increase in the number of inquiries from textile mills is encouraging. Construction work is progressing favorably in the Middle West, maintenance purchasing is large and industrial buying appears strong. On the Pacific Coast a general improvement is noticed in all branches of the electrical business and power company buying is brisk.

European Conditions Better—Power Development Rapid

EUROPEAN business conditions seem to be generally better, in the opinion of H. E. Irish, purchase engineer of the Western Electric Company, who has just returned after a six months' business trip abroad. "Credit and money are to some extent more stable; unemployment, although still serious in England, has been greatly reduced in Germany and is not an important factor in France, and political conditions, upon which almost everything depends, seem gradually to become somewhat more settled," said Mr. Irish. The development of power and light companies is going ahead rapidly in many countries, but the lack of

Value of Electrical Exports for April, 1925, Compared with Corresponding Month in 1924

(Issued by Bureau of Foreign and Domestic Commerce)

Articles	April 1924	April 1925
Generators:		
Direct-current		
Under 500 kw.	$140,915	$91,387
500 kw. and over	109,693	5,000
Alternating-current		
Under 2,000 kva.	30,598	54,416
2,000 kva. and over	58,545	39,393
Steam-turbine generator sets	405	4,637
Accessories and parts for generators	32,589	42,586
Self-contained lighting outfits	58,778	95,384
Batteries:		
Flashlight	90,965	137,126
Other primary	70,419	92,215
Storage	246,219	315,494
Transforming or converting apparatus:		
Power transformers	302,024	254,510
Other transformers	285,399	148,524
Rectifiers, double-current and motor generators, dynamotors, synchronous and other converters	122,902	158,484
Transmission and distribution apparatus:		
Switchboard panels, except telephone	259,593	326,733
Switches and circuit breakers over 10 amp.	263,325	113,583
Fuses and fuse blocks	25,834	24,123
Watt-hour and other measuring meters	30,116	60,307
Volt, watt and ampere meters and other recording, indicating and testing apparatus	100,829	177,049
Lightning arrestors, choke coils, reactors and other protective devices	108,286	47,540
Motors, starters and controllers:		
Motors, under 1 hp	168,892	193,531
Stationary motors:		
1 to 200 hp.	214,738	174,326
200 hp. and over	76,189	66,404
Railway motors	112,278	56,341
Electric locomotives:		
Railway	213,196	5,860
Mining and industrial	61,051	18,618
Starting and controlling equipment for:		
Industrial motors	108,170	128,250
Electric railway and vehicles	1,327	3,609
Accessories and parts for motors	171,471	161,064
Electrical appliances:		
Electric fans	97,460	64,999
Electric lamps:		
Metal-filament	86,062	117,183
Other electric lamps	27,474	18,989
Flashlights	$62,547	$131,260
Searchlights and projectors	17,705	56,474
Motor-driven household devices	107,183	131,691
Domestic heating and cooking devices	84,861	150,291
Industrial electric furnaces and ovens	20,450	8,598
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	99,797	107,754
Signal and communication devices:		
Radio apparatus	299,903	853,148
Telegraph apparatus	224,880	54,442
Telephone apparatus:		
Magneto telephones	29,505	10,141
Other telephones	71,743	35,815
Telephone switchboards	88,927	122,523
Other telephone equipment	236,756	173,829
Railway signals, switches and attachments	86,609	107,880
Bell buzzers, annunciators and alarms	16,287	16,902
Other electric apparatus:		
Spark plugs, magnetos, and other ignition apparatus	268,752	173,785
Insulating material	111,867	141,082
Metal conduit, outlet and switchboxes	43,306	79,929
Sockets, receptacles and lighting switches	107,847	147,987
Electric lighting fixtures, interior and street	45,809	103,091
Other wiring supplies and line material	113,613	157,887
Other electrical apparatus	763,628	597,048
Globes and shades for lighting fixtures	32,217	37,557
Electrical glassware, except for lighting	23,800	27,539
Electrical porcelain	160,837	†
Less than 6,000 volts	*	64,498
6,600 volts and over	*	179,756
Electrical carbons, carbon brushes and electrodes	303,293	†
Electodes for electrical furnaces	*	85,117
Other carbon products	*	169,141
Insulated wire and cable (iron and steel)	44,911	54,210
Other manufactures of aluminum	54,412	48,719
Copper, bare wire	153,645	148,037
Copper, insulated wires and cables	271,588	443,388
Total electrical machinery and apparatus and supplies	$7,420,420	$7,817,184

* Not separately stated prior to January 1, 1925.
† Discontinued beginning January 1, 1925.

standardization is a serious bar to manufacturers seeking to enter this field. There is always a certain demand for American electrical equipment, but in the main Mr. Irish believes that the American contribution will be along the line of leadership in new technical developments rather than the export of any great quantity of supplies.

"This is in part because electrical development is influenced to so large an extent by political conditions," said Mr. Irish. "The telephone, radio, and in some instances power, are in general controlled by the governments. The use of electricity was stimulated by the war and is probably growing faster than it otherwise would have grown, but most of the manufacturing will probably continue to be done in local national factories. The employment situation has added force to this policy, which is a deliberate one. Home industry is generally supported even when better supplies could be obtained from another country at lower prices. This preference for home products will probably continue. National feeling at the present time is particularly high, and the opportunities for exporting electrical supplies to Europe may be less now than at some periods in the future."

Radio is apparently popular, and Mr. Irish received the impression that a much wider popularity is at hand. This, however, seems to be limited by inherent characteristics of European nations, which will probably prevent a sweep of radio enthusiasm comparable to that in the United States.

Copper and Lead Decline Slightly —Other Metals Steady

THE buying movement in copper subsided as suddenly as it started, and since last week (Thursday) the market has been quiet with prices receding to the previous level. Lead has been in moderate demand at somewhat lower prices. Late last week (Wednesday) most producers raised their copper quotations to 13⅞ cents delivered, and on Thursday a fairly good tonnage was sold at this price, both for Connecticut and up-state delivery. Some metal was still offered for 13¾ cents, and this was readily sold. On the following day (Friday), the bottom seems to have dropped out of the market, and producers have since then been able to make sales only by cutting prices. Consumers continue loath to buy much ahead of requirements.

The American Smelting & Refining Company's contract price for New York lead was reduced from 8.40 cents to 8.30 cents on Thursday, June 18, and again on June 24 a further reduction to 8.20 cents was made. The demand for lead continues to be modest compared with what it was two or three weeks ago, but is far from non-existent, as consumers are buying only for their immediate requirements and cannot stay out of the market for long. The zinc market is as quiet as ever, with the domestic prices governed by what can be obtained for the metal abroad. A fairly good export inquiry was in evidence yesterday, perhaps occasioned by a reported strike in Antwerp, but the foreign market is not particularly active today. Tin was in good demand for both spot and forward delivery in the last three days, with consumers showing more interest than for some time.

NEW YORK METAL MARKET PRICES

	June 17, 1925 Cents per Pound	June 24, 1925 Cents per Pound
Copper, electrolytic	13¾	13¾
Lead, Am. S. & R. price	8.40	8.20
Antimony	16¾	16½
Nickel, ingot	34	34
Zinc, spot	7.30	7.32½-7.35
Tin, Straits	56	56¼
Aluminum, 99 per cent	28	28

Base copper price June 24, 1925, 16 cents.

Building Construction Continues at Record Rate

BUILDING continues at a record-breaking rate, according to the F. W. Dodge Corporation. Contracts awarded last month in the thirty-six Eastern States, which include about seven-eighths of the total construction volume of the country, reached a total of $496,024,100. This was the second highest monthly total ever recorded, having been exceeded only in April of this year. There was a decline of 9 per cent from April, a seasonal decline in May being customary. There was at the same time an increase of 18 per cent over May, 1924.

Last month's record included the following important items: $231,182,200, or 47 per cent of all construction, for residential buildings; $80,280,100, or 16 per cent, for commercial buildings; $77,759,400, or 16 per cent, for public works and utilities; $29,312,700, or 6 per cent, for educational buildings; and $27,562,000, or 6 per cent, for industrial plants. Construction started during the first five months of this year has amounted to $2,119,564,100, an increase of nearly 10 per cent over the corresponding period of last year. Contemplated new work reported in May amounted to $712,853,000, an unusually large amount for so late a month. It was only 6 per cent under the April figure, and it was 24 per cent over the amount reported in May of last year.

Business Outlook Improves in the Southeast

DESPITE a continuance of the very hot and dry weather in the Southeast, electrical men report an improvement in the business outlook over that of a month ago. In part this can be accounted for by the fact that building permits for May in the Southeastern states totaled $71,835,700—the highest monthly total recorded to date in this section. Jobbers report that conduit is

in good demand and that scheduled material for the larger jobs is selling in a fairly active manner. Most of this material is being used for the construction of commercial rather than industrial buildings. Safety switches and wiring devices are also selling actively, but the demand for armored conductor is reported somewhat slow. Fans are selling with more than anticipated briskness, and the demand for exhaust fans is very active.

The increase in the number of inquiries being received from textile mills is encouraging, especially in view of the curtailing of operations that is contemplated by a number of the mills. Evidently they intend to take advantage of such period of curtailment to make needed repairs and additions.

Construction Work Progressing in the Middle West

CONSTRUCTION work of the various utility companies is progressing favorably in the Middle West, and industrial purchasing appears stronger. Maintenance purchases remain larger and help materially to increase the volume of business. The demand for crossarms and poles has been quite good, and there have been steady sales of high-tension equipment.

Jobbers' sales have been good in most cases. The demand has been somewhat irregular, but the average has been satisfactory. Wire and conduit moved briskly and socket appliance sales have been better than anticipated. One jobber placed orders this week for 1,000 vacuum cleaners, 200 washing machines, 500 electric cookers and a considerable quantity of toasters, flatirons, etc. Prices have been somewhat erratic. One manufacturer of Western red cedar poles withdrew all outstanding quotations. A manufacturer of porcelain insulators reduced the price of telephone screw-thread insulators 25 per cent, secondary rack insulators 20 per cent and some types of high-tension insulators 5 per cent to 25 per cent. Two conductor armored cable, No. 14, was reduced approximately 5 per cent together with other armored cables, including lead-covered conductors. Code wire, however, advanced in price from 2½ per cent to 5 per cent in a general increase, and manufacturers in this territory admit that they are looking for further advances before long.

Good Sales to Industrial Plants in the New York District

BUYING by industrial plants is good in the New York district. Many sales have been made, while the inquiries received by manufacturers presage several interesting future sales. Municipal projects under way will also require a fair amount of electrical material. Central-station plants continue to buy material in steady volume, and their construction work is being maintained at a rate that is keeping full construction gangs steadily at work. Manufacturers also report that they have been advised of many central-station projects which will require a large amount of material.

There has been a falling off in business noted by the jobbers, largely owing to the decreased sales of fans. Rubber-covered wire has increased in price from 5 per cent to 10 per cent, but no increase in demand is yet noticeable. Sales of appliances are fair. At least two appliance manufacturers have announced aggressive nation-wide advertising campaigns which should stimulate business.

Industrial Equipment Active in the New England District

THE demand for industrial equipment has been very active in the New England district with sales of small motors ranging from 5 hp. to 50 hp. most prominent. One manufacturer reports brisk sales to date for June, with a good volume coming from Vermont; another records an upward trend in the demand from the whole district, owing in part to factory additions and in part to shop reorganization from group drive to individual drive. This pronounced movement in small motors has reflected an active interest in circuit-breakers and control apparatus. Overtime production and full working forces are reported by one manufacturer to meet the demand for this type of equipment.

Electric industrial heating maintains an encouraging activity, and many inquiries are reported from tool-making and machinery industries. Sales of domestic electrical appliances are spotty with the exception of refrigerating units. A group of seven distributors reported more than sixty sales of this product and, in addition, between twelve hundred and fourteen hundred live leads. Throughout New England building construction is thriving, but there is a lagging among many manufacturing industries. Machine output has slackened during the past few weeks, and the shoe and textile industries continue to maintain a subnormal level.

General Improvement Noticed on the Pacific Coast

BUSINESS in all electrical branches on the Pacific Coast is perceptibly better. For instance, contractors' orders, which usually taper off during midmonth, are better than they have been since March. Rubber-covered wire and schedule material are the best selling staples. Dealers and jobbers report good schedule sales. Because of heavy Coast stocks this has not yet reacted upon the manufacturers. Railroad business is exceptionally fine, many of the orders being spectacular in size, such as those for 25,000 ft. of 2-in. sherardized conduit, 100 miles of No. 6 "BB" galvanized telegraph wire, 20,000 ft. of 7/8-in. high-strength strand and 10,000 dry batteries. Power company purchasing is also brisk, including two carloads of fiber conduit and a great quantity of anchor rods, guy clamps and other pole-line hardware in 3,000-5,000-lb. lots.

Some good orders and inquiries have been received from pumping and industrial plants for switches, poles and enameled-steel reflectors. The recent price flurry on standard porcelains produced comparatively little business, dealers being cautious of such a falling market. Judging from inquiries received, the closing down of logging camps for an indefinite period and lumber mills until after July 4 will mean increased sales of motors and other equipment for replacements and other work.

Activities of the Trade

Union Metal Manufacturing Increases Factory Capacity

W. A. Porterfield, vice-president and general sales manager of the Union Metal Manufacturing Company, Canton, Ohio, manufacturer of ornamental street-lighting standards and exterior lighting units, announces that his company has acquired new property, adjoining its present plant, which will practically double the manufacturing capacity. Arrangements have also recently been made with the largest foundry in Los Angeles whereby "Union-Metal" products for use in the Pacific Coast section will be manufactured there.

Mr. Porterfield reports that the total sales of his company for 1925 up to June 15 were 100 per cent greater than in any previous year. Foreign sales showed a 400 per cent increase in 1924 with a correspondingly large increase to date in 1925. This increased volume of sales has necessitated a broader official personnel and increased working capital. A reorganization has, therefore, been effected, transferring a large part of the stock ownership, which has previously been rather closely held by one family, to a group of men representing influential connections in utility and financial circles in the Middle West.

The personnel of the sales, service and operating divisions of the organization remains intact. The following officials were elected at a recent meeting: C. C. Barrick, president; Harry Ross Jones, chairman of the board; Chester A. Orr, vice-president and treasurer; W. A. Porterfield, vice-president and general sales manager, and F. McGlashan, secretary.

General Electric Gets Order for Equipment for Car Dumper

The General Electric Company has received an order for the electrical equipment for operating the first all-electric car dumper to be installed on the Great Lakes. The dumper is being built by the Wellman-Seaver-Morgan Company for the Toledo & Ohio Central Railroad at Toledo. It will be used for transferring coal from railroad cars to lake boats and will be capable of handling cars ranging in capacity up to 120 tons at the rate of forty an hour.

The National Carbon Company, 30 East Forty-second Street, New York, announces that it has established a new district sales office and warehouse at 600 Second Avenue, Pittsburgh, which

will carry complete stocks of "Eveready" flashlights, radio batteries, miniature lamps and automotive brushes and "Columbia Eveready" dry cells. The new district will be under the direction of W. H. Haile, district manager, and R. P. Tolles, assistant district manager, who will have charge of the region comprising Ohio, West Virginia, the eastern portion of Kentucky, the western portions of Pennsylvania, New York and Virginia and the two most westerly counties in Maryland.

The Western Electric Company announces that it has recently opened up a new supply distributing house at Houston, Tex. The new building has a floor area of 20,000 sq.ft.

The Ward Leonard Electric Company, Mount Vernon, N. Y., manufacturer of resistor units and control apparatus, announces the appointment of Warburton, Franki, Ltd., of Sydney and Melbourne, Australia, as its selling agents in that territory.

The Timken Roller Bearing Company, Canton, Ohio, announces the appointment of Elliott A. Allen as district manager of sales in the New England territory, with offices at 1107 Commonwealth Avenue, Boston.

The Adapti Manufacturing Company, Cleveland, has announced a new line of floor boxes and fittings for "under-floor" installation that can be installed in any type of fireproof floor construction.

The Albert Sechrist Manufacturing Company, 1717 Logan Street, Denver, manufacturer of lighting fixtures and pressure-type cookers, announces that K. L. Francis, formerly general manager, has been elected president of the company, following the recent death of Mrs. Hattie Sechrist.

The Fuller-Lehigh Company, Fullerton, Pa., manufacturer of pulverizing equipment, etc., has purchased the pulverized-coal business of the Bonnot Company, Canton, Ohio, including the rights to the Bonnot "Unit-Air" ball mill.

The Azor Manufacturing Company, Cleveland, announces the new Azor home-ventilating fan having a capacity of 600 cu.ft. per minute and weighing only 15 lb. The company also announces the Azor "superfan," a larger and more powerful unit, for the ventilation of stores, offices and workrooms. This fan has a capacity of 2,500 cu.ft. per minute and weighs 54 lb.

The Westinghouse Electric & Manufacturing Company has received orders for electrical marine equipment aggregating close to $100,000, including generators, motors and auxiliaries, for two big oceangoing vessels now being finished at the Chester (Pa.) yards of the Sun Shipbuilding Company. The main drive of both these ships will consist of Sun-Doxford Diesel engines.

The W. N. Matthews Corporation, St. Louis, manufacturer of electrical specialties and mechanical painting equipment, announces the appointment of L. M. Meckler as sales engineer with the New York office, which is at 30 Church Street. Mr. Meckler was formerly electrical engineer in the distribution department of the Public Service Electric & Gas Company, Newark.

The General Electric Company has appointed Robert Miller, formerly manager for Salt Lake City, as Rocky Mountain district manager, with headquarters at Denver, succeeding Harry D. Randall, who has been assigned to special duties at the general office of the company at Schenectady. B. C. J. Wheatlake, formerly head of the central-station department of the company at Denver, has been appointed manager at Salt Lake City.

The Westburg Engineering Company, Chicago, Western representative of the Weston Electrical Instrument Corporation, Newark, N. J., reports the installation of Weston electric speed indicators on turbines at the Crawford Avenue station of the Commonwealth Edison Company, Chicago. These instruments have also been used on several recent passenger elevator installations. The company also reports the installation of eighty-eight of these indicators on locomotives of the Rock Island Railroad Company, where the indicators are used in connection with this railroad's automatic train-control equipment.

The Chase Companies Incorporated, Waterbury, Conn., announce that about July 1 they will move the New York offices of the Chase Metal Works and the Waterbury Manufacturing Company to 138 Lafayette Street. Complete stocks of Chase brass in sheet, rod, wire and tubing will be carried at this address for the convenience of the trade.

The Newark Transformer Company, 71 Hamilton Street, Newark, N. J., announces that on July 1 it will move its plant to the building it has purchased at 17 Frelinghuysen Avenue. In its new plant the company will have available twice as much floor space for the manufacture of transformers.

The Robbins & Myers Company, Springfield, Ohio, manufacturer of electric motors, generators and fans, announces that C. A. Stirling, for the past six years general manager of the Robbins & Myers Company of Canada, Ltd., has been made manager of the New York sales office. Mr. Stirling has been succeeded by K. C. Berney, for the last five years designing and general engineer at Springfield.

New Equipment Available

Power Relay

A power relay for use in limiting the power on distribution lines to a predetermined quantity has been developed by the General Electric Company. The relay can be calibrated without removing the cover by means of a knob projecting through the glass window at the upper part of the case. It has a large range of calibration, running from zero to 1,000 watts, secondary; heavy contacts are used, and the internal mechanism is said to be very simple. This relay is manufactured in three forms—the "IG-102" an "over-power" and "under-power" device with contacts for controlling either alternating or direct current, and two "over-power" devices, one for alternating current and the other for direct current, known as the "IG-103" and "IG-104" respectively.

Undervoltage Device

A self-resetting undervoltage device for large solenoid-operated air circuit breakers has been developed by the General Electric Company. This device was designed so that its armature, after having tripped the breaker, is brought back to the reset position against the core until voltage returns, eliminating the necessity of hand resetting. The method followed utilizes the movement of the breaker mechanism in opening for the purpose of resetting. It is made for use on breakers of 3,000 amp., 4,000 amp., and 6,000 amp.

Selective Impulse Relay

A relay for use in testing meters singly or in groups, providing an automatic start and stop method, has been developed by the States Company, Hartford, Conn. It is said that this method of testing does not depend upon the judgment of the tester, and successive tests of a meter when using the relay will give results which are more nearly identical than when made with a hand-operated snap switch. Personal errors are thus eliminated so far as the starting and stopping of the meter is concerned. This relay when included in the equipment of the States meter-test tables is said to assure greater accuracy in testing single meters and to assist materially in increasing the number of meters it is possible to test each day at a substantially reduced cost.

Transformer Cooling Unit

A transformer cooling unit consisting primarily of an automotive core-type radiator mounted horizontally in a sheet metal stack has been put on the market by Hanson, Jones & Morey, 219 West Seventh Street, Los Angeles. The unit is called the "H-J-M cooling unit." The transformer oil to be cooled is pumped through the radiator at the most efficient velocity and cooled by the natural draft of air set up in the stack. The approximate cooling capacity of one standard unit is 3,000 kva. With 60 gal. of oil per minute flowing the temperature drop averages 15 deg. F. The oil flow is varied to suit the conditions. The device is applicable to oil-circulated banks of 2,000 kva. capacity and above where the cost of self-cooled transformers is high.

Speed Regulator.—For regulating the speed of 1/20-hp. to ½-hp. direct-current motors driving small fans, blowers, etc., the Cutler-Hammer Manufacturing Company, Milwaukee, has placed on the market the Bulletin 3291 manual speed regulator. It is also suitable for regulating the current strength of motor fields, as a dimmer for small lighting circuits, as a heating-coil regulator, etc. The regulator is inclosed and is of the face-plate type.

New Trade Literature

ELECTRIC RANGES.—Booklet E issued by the Magee Furnace Company, 38 Union Street, Boston, covers the various types of the Magee ranges for electricity and coal or electricity, gas and coal.

DIRECT-CURRENT MOTORS. — The Robbins & Myers Company, Springfield, Ohio, has issued bulletin No. 141, covering its types "S," "C" and "I" direct-current motors, which are manufactured in capacities from ¼ hp. at 870 r.p.m. to 20 hp. at 1,160 r.p.m.

ELECTRIC FOLDING IRONER.—The Hurley Machine Company, 24 East Jackson Boulevard, Chicago, is distributing a folder covering the new "Thor" No. 30 electric folding ironer.

AUTOMATIC ARC WELDING.—Bulletin No. 48,937.1 issued by the General Electric Company, Schenectady, N. Y., entitled "Automatic Arc Welding," contains a summary of the uses and value of automatic arc welding, together with a description of the welding apparatus and generating equipment. Illustrations are given showing the equipment and actual applications.

RECORDING THERMOMETERS.—Catalog No. 1,303 issued by the Bristol Company, Waterbury, Conn., covers its various types of Bristol gas-filled recording thermometers for temperatures between 60 deg. below zero and 1,000 deg. F. It also contains numerous charts showing various applications of the thermometers. The company is also distributing bulletin No. 1,501, in which it describes and illustrates new models of the Bristol electrical recording voltmeters, ammeters and high-speed contact-making recording voltmeters.

ELECTRIC TRUCKS. — "Developing Markets for Electric Trucks" is the title of a book issued by the Walker Vehicle Company, State and Eighty-seventh Streets, Chicago, in which it calls attention to what electric truck manufacturers are doing to develop markets for electric trucks. It contains booklets and other literature showing the benefits of electric trucks in various industries, including department stores, express, transfer, storage, laundry and milk delivery service.

PROTECTIVE APPARATUS. — The Johns-Pratt Company, Hartford, Conn., has issued catalog No. 55, covering its line of "Noark" protective products, comprising six sections issued in bulletin form. Sections 1, 2 and 3, covering its meter service switches, fuses and cut-outs and cast-iron service boxes respectively, are included in the catalog. Sections 4, 5 and 6, describing its underground boxes (cast iron or aluminum), molded material and packing respectively, will be distributed as soon as issued.

WEATHERPROOF SOCKET.—The Benjamin Electric Manufacturing Company, 120 South Street, Chicago, is distributing a folder describing the Benjamin No. 4,200 "Benco" weatherproof socket for heavy-duty industrial use. Attention is also called to the "Benco" outlet box fittings (type "S"). Illustrations are given showing an installation using "Benco" sockets with Benjamin dome reflectors, and of outlet box fittings, with typical glass diffusing bowl.

STARTING SWITCHES AND AUTOMATIC STARTERS. — The Electric Controller & Manufacturing Company, 2700 East Seventy-ninth Street, Cleveland, has issued bulletin No. 1,048, describing its new "E.C.&M." type "ZO" push-button-operated oil switch for starting squirrel-cage motors and also single-phase motors. The company is also distributing two leaflets covering the "E.C.&M." cushion tank for alternating-current and direct-current, electrically operated automatic pumping stations; single-pole magnetic contactor, No. 00, type S contactor, for direct current, and No. 00, type ZS contactor for alternating current.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency is desired in Valencia, Spain (No. 15,533), for dry cells and storage batteries and radio sets and parts.

Purchase or agency is desired in Liverpool, England (No. 15,535), for electrical equipment and supplies and radio sets and parts.

Purchase and agency is desired in Vienna, Austria (No. 15,602), for electrotechnical novelties.

Purchase is desired in Stuttgart, Germany (No. 15,600), of power-plant apparatus. Purchase and agency is desired (No. 15,601) for radio sets and parts.

An agency is desired in Copenhagen, Denmark (No. 15,534), for radio sets and parts.

Purchase is desired in Athens, Greece (No. 15,536), of radio sets and parts.

Purchase is desired in Constantinople, Turkey (No. 15,537), of 300 tons of iron and bronze wire and 5,000 copper sleeves.

Purchase and agency is desired in Oslo, Norway (No. 15,538), for enameled magnet wire and covered wire.

Purchase is desired in Madras, India (No. 15,297), of power-plant machinery.

An agency is desired in Madrid, Spain (No. 15,296), for radio sets and parts.

An agency is desired in Melbourne, Australia (No. 15,298), for radio sets and parts.

An agency is desired in Porto Alegre, Brazil (No. 15,337), for radio sets and parts and wiring supplies.

An agency is desired in Belfast, Ireland (No. 15,309), for radio sets and parts, two, three, four and five-tube sets (neutrodyne and superhetrodyne); loudspeakers with or without horns; batteries A, B and C; radio tool outfits and tubes.

An agency is desired in Alexandria, Egypt (No. 15,389), for electric automobile accessories.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

PORTLAND, ME.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 6 for furnishing and installing lighting fixtures, wiring, etc., in the United States Marine Hospital, Portland, Me. For details see Searchlight Section.

WINCHESTER, MASS.—Bids are being asked for the construction of a power house and laundry for the Winchester Hospital, to cost about $40,000. Kendall Taylor & Company, 142 Berkley Street, Boston, are architects.

HARTFORD, CONN.—Bids will be received by the Board of Contract and Supply until June 30, for about 38,500 ft. of wire cable, in sizes from No. 7 to No. 50. C. DeLancy Alton is secretary.

HARTFORD, CONN. — Electric power equipment will be installed in the printing plant, to be erected by the Travelers' Insurance Company at 20 Prospect Street, to cost about $500,000.

Middle Atlantic States

ALBANY, N. Y.—An ordinance has been introduced in the City Council calling for an appropriation of $30,000 for traffic lamps to be placed at various points in the city.

BEACON, N. Y.—Bids will be received by James L. Long, Superintendent of Prisons, Capitol, Albany, until June 29 for construction, heating, sanitary and electric work of hospital building and kitchen and dining room (new group) and addition to main group, Matteawan State Hospital, Beacon. Sullivan W. Jones, Capitol, Albany, is State Architect.

BROOKLYN, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until June 30 for construction, heating, sanitary, electric work, and refrigeration work for buildings A, B, C, H, I, K, L, M, N, T, X, Y, EE, FF, HH, etc., at the Brooklyn State Hospital, Queens (Creedmoor), Long Island. Sullivan W. Jones, Capitol, Albany, is State Architect.

GOUVERNEUR, N. Y.—Bids will be received by the Board of Lighting Commissioners until July 9 for the construction of a hydro-electric development. The work will include a concrete dam 175 ft. long and 7 ft. high and power house, and also dismantling of the old dam and building foundations; two single-runner vertical waterwheels, capable of developing 100 hp. under 7-ft. head, governors, etc.; two 100-kva., 60-cycle, three-phase, 2,300-volt vertical generators, with direct-connected exciters, one five-panel switchboard with equipment and two street-lighting transformers. Lewis C. Reynolds, 387 Castle Street, Geneva, is engineer.

HERKIMER, N. Y.—The Municipal Lighting Commission has been granted permission to extend the lighting system into the town of Herkimer, covering a distance of about 1¼ miles. It is also planned to establish a street-lighting district in the new territory. Another 2,000-kw. generating unit will be installed in the municipal electric plant to enable it to take care of the additional territory.

JAMESTOWN, N. Y.—Bids will be received by the Board of Public Utilities, until June 30 for extension to power house of the Steele Street lighting plant. Louis T. Klauder, Bankers Trust Biulding, Philadelphia, is consulting engineer.

NEW YORK, N. Y.—Bids will be received by the New York Central Railroad Company, room 344, 466 Lexington Avenue, until July 8, for electric locomotives (Serial Contract No. 16, 1925). W. C. Bower, manager of purchases and stores.

SALEM, N. Y.—The Salem Light, Heat & Power Company has been granted authority to extend its distribution system to serve the towns of Hebron, Salem and Jackson under franchises granted by the Town Boards. A street-lighting system will be installed in Hebron.

SYRACUSE, N. Y.—Plans are under way for the construction of a new power plant at the Syracuse University, to cost about $50,000. W. H. Peck, Third National Bank Building, Scranton, Pa., is architect.

WESTMORELAND, N. Y.—The Adirondack Power & Light Corporation, Schenectady, has applied for permission to extend its transmission line to Westmoreland and to exercise franchise rights in the town. The company is planning to erect a new high-tension transmission line from Utica to Oneida, from which energy will be secured for this service.

MILLBURN, N. J.—The Central Jersey Power & Light Company, Morristown, has applied for permission to take over the system of the Millburn Electric Company. Extensions and improvements are planned in this section.

WEST MILFORD, N. J.—The West Milford Electric Company contemplates the construction of a steam-operated electric power plant for service in a portion of Passaic County.

HANOVER, PA.—Steps have been taken by the Chamber of Commerce to secure the installation of an ornamental lighting system in the business district.

PHILADELPHIA, PA.—Bids will be received by the Quartermaster, Marine Corps, Philadelphia, until June 30, for 10,000 dry batteries and 10,000 flashlight batteries (Schedule 19).

SAYRE, PA.—The Chamber of Commerce has applied to the Borough Council for permission to install an ornamental lamp on Desmond and Lockhart Streets and Packer Avenue, to be installed and maintained by the merchants on those thoroughfares.

WILDERMING, PA.—The United Electric Light Company is considering the construction of a steam-driven power plant on the Monongahela River, near Braddock, to cost about $150,000. Day & Zimmermann, Inc., 1,600 Walnut Street, Philadelphia, is engineer.

RONCEVERTE, W. VA.—Bids will be received by the city of Ronceverte at the office of A. S. Woodhouse, city clerk, until June 29 for improvements to waterworks as follows: Filter plant of 500,000 gal. capacity, settling basin, two filter units, piping and electric pump rooms, etc.; changing present high-pressure electrically driven centrifugal pumps to new plant, electric wiring, etc.; furnishing two centrifugal pumps of 350 gal. per minute each against a head of 25 ft. directly connected to 5-hp. electric motors, 220 volts, alternating current, with starters. H. K. Bell Hernando Building, Lexington, Ky., is engineer.

ROANOKE, VA.—The Roanoke-Staunton Power Company plans to build three power dams on the Roanoke River, at Lynnville Ford, Deerford Ford, and Anthony's Ford, respectively, for its proposed hydro-electric plant. The initial installation will have an output of about 40,000 hp.

WINCHESTER, VA.—The City Council is considering extensions to the street-lighting system.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Ac-

counts, Navy Department, Washington, until July 7, for 1,200 porcelain insulators (Schedule 3946).

WASHINGTON, D. C.—Bids will be received by the United States Veterans' Bureau until June 29, for electric light fixtures, including single bulb holders, sockets, screw plugs and wall plates (Proposal R-107).

North Central States

ADRIAN, MICH.—Negotiations are under way by the City Commission for extensions to the ornamental lighting systems in the downtown and Tecumseh Street business sections.

ALBION, MICH.—The City Council has decided to accept the proposal of the Consumers Power Company, Jackson, for the installation of a complete new street-lighting system, to cost about $33,000. The present lamps will be replaced with lamps of 250 cp. throughout the city, except on Superior Street, where the cluster lamps now in use will be supplanted by single lamps of 400 cp.

DETROIT, MICH.—Extensions and improvements are contemplated by the Michigan Bell Telephone Company in Detroit this year, to cost about $10,000,000, including $2,100,000 for cables and lines.

ROCKFORD, MICH. — The Wolverine Shoe & Tanning Company plans to build an addition to its power plant, to cost about $50,000.

SANDUSKY, MICH.—The City Council has approved the sale of the municipal electric plant to the Michigan Electric Power Company, Bad Axe, which plans to extend its transmission line for local service.

CINCINNATI, OHIO.—A permit has been granted the Union Gas & Electric Company to build a substation at 2215-19 Spring Grove Avenue, to cost about $40,000.

CINCINNATI, OHIO.—Work will soon begin on the construction of an addition to the engineering building, of the University of Cincinnati, to be equipped as an electrical laboratory. Harry Hake, Cincinnati, is architect.

CINCINNATI, OHIO.—Plans are under way for building an addition to the power plant at the Deaconess Hospital, at Clifton Avenue and Straight Street. Samuel Hannaford & Sons, Cincinnati, are architects.

CLEVELAND, OHIO.—Separate bids will be received by the Commission of Purchases and Supplies, City Hall, until July 3 for paper insulated, lead-covered cable, and for series multiple transformers for the Division of Light and Power.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until July 1, for 6-volt 11-plate, 6-volt 13-plate, 6-volt 15-plate, 12-volt 7-plate, 12-volt 9-plate and 12-volt 11-plate storage batteries for the Division of Light and Power.

LORAIN, OHIO.—Work will begin at once by the Ohio Public Service Company, Cleveland, on the erection of a 130,000-volt transmission line from Lorain to Sandusky.

MARBLEHEAD, OHIO.—The Ohio Public Utilities Commission has granted the Ohio Public Service Company, Cleveland, permission to acquire the property of the Marblehead Power Company. Improvements are contemplated to the local plant.

SPRINGFIELD, OHIO.—The Ohio Edison Company plans to build a switching station at its power plant to cost about $240,000. A contract for the building has been awarded to A. G. Samuelson, Springfield.

YOUNGSTOWN, OHIO.—The City Council plans extensions to the ornamental lighting system in West Federal, Market and Mahoning Avenues. The Pennsylvania-Ohio Power & Light Company furnish the street-lighting service.

CARROLLTON, KY. — The municipal electric light and water plant has been acquired by the Kentucky Power Company, Augusta. Improvements, it is understood, will be made to both the electric and water plants.

SHEPHERDSVILLE, KY.—Negotiations are under way by the Louisville Gas & Electric Company and the Town Trustees whereby the former will furnish electric service here. The company proposes to take over the local plant and to extend its transmission line from Okolona to Shepherdsville. Electricity will also be supplied to farms and residences along the proposed line.

BLUFFTON, IND.—The City Council has rejected all bids submitted for extensions and improvements to the municipal electric plant and waterworks. New bids, it is understood, will soon be asked for. Everett I. Brown, Studebaker Bank Building, is architect.

MADISON, WIS.—The Wisconsin Gas & Electric Company plans to erect a 132,000-volt transmission line to the northern Michigan district, where it will connect with the power plants of the Peninsula Power Company.

WEST ALLIS, WIS.—A resolution has been adopted by the City Council authorizing the installation of an ornamental lighting system on National and Greenfield Avenues from the east city limits to Sixty-second Avenue.

ALBERT LEA, MINN.—The installation of an ornamental lighting system on Bridge Street from Clark Street to the Fair Grounds is under consideration by the City Council.

BELLE PLAINE, MINN. — Steps have been taken by the Belle Plaine Community Club for the installation of an ornamental lighting system.

BEMIDJI, MINN.—Bids will be received by Belle Denley, City Clerk, until July 6 for a franchise for an electric light and power plant and distribution system.

MINNEAPOLIS, MINN. — The Tenth Ward municipal electric plant was recently damaged by a storm, causing a loss of several thousand dollars. The power and crematory committee of the Council has recommended connecting up the system with the Minneapolis General Electric Company's lines.

MOORHEAD, MINN.—An election will be held July 20 to vote on the proposal to issue $50,000 in bonds for repairs to the municipal electric and water plant. The proposal to issue $135,000 in bonds to build a new plant in the downtown section was defeated at a special election held May 14.

MAPLETON, IOWA.—A temporary injunction restraining the town of Mapleton from building a municipal electric plant has been dismissed in the District Court. Work on the construction of the plant, it is expected, will be resumed at once.

ATLANTA, MO.—The Missouri Power & Light Company, Mexico, is erecting a transmission line from La Plata to Atlanta, to supply energy for the local system. The local power house will be converted into a substation.

BRAGG CITY, MO.—Bonds to the amount $21,000 have been voted, the proceeds to be used for extensions in the electric lighting and waterworks systems.

COLUMBIA, MO.—The City Council contemplates extensions and betterments in the municipal electric plant and waterworks, to cost about $50,000. The Burns & McDonnell Engineering Company, Kansas City, is engineer.

KANSAS CITY, MO.—The Kansas City Power & Light Company has applied for permission to make a number of extensions to its transmission lines.

KANSAS CITY, MO. — The Chicago & Alton Railroad Company, 340 West Harrison Boulevard, Chicago, plans to install electric power equipment at its proposed local grain elevator on Hardesty Avenue, to cost about $350,000.

OWENSVILLE, MO. — The proposal to grant the Gasconade Power Company, Mexico, a twenty-five year franchise and a ten-year contract for street lighting has been approved by the voters. If approved by the Public Service Commission the Gasconade company will take over the local power plant, owned by S. H. Helling. The same propositions with a bond issue of $3,500 were voted at Belle. The village of Eland is considering granting the company a franchise and contract for lighting that village.

GARRISON, N. D.—The Central Light & Power Company, Washburn, plans extensions in its local power plant, to cost about $20,000.

McPHERSON, KAN.—Investigations are being made with a view of installing a new ornamental lighting system.

Southern States

RINGGOLD, GA. — The installation of electric lighting system is under consideration by the City Council.

STATESBORO, GA.—The citizens have authorized the Mayor and Council to sell municipal electric plant to the Interstate Utilities Corporation, Washington, D. C.

BUSHNELL, FLA.—Bonds to the amount of $62,000 have been authorized for improvements to the water and lighting systems. Of the proceeds $7,000 will be used for the lighting system.

CEDAR KEYS, FLA.—The Cedar Keys Light & Power Company plans to install a 100-kw. generator unit and to build a 40-ton ice plant addition.

EDGAR, FLA.—The Edgar Plastic Kaolin Company plans extensions and improvements to the power plant at its local clay-mining properties, including the installation of additional equipment. The company also plans additions to its power plant at McIntyre, Ga., to cost about $45,000.

PANAMA CITY, FLA.—The construction of a power plant in Panama City is reported to be under consideration by the Atlanta & St. Andrews Bay Railroad.

ST. AUGUSTINE, FLA.—The City Council is considering the installation of a new street lighting system.

SARASOTA, FLA.—The Board of Public Works has accepted the offer of the Florida Power & Light Company, Miami Beach, to take over the municipal electric plant, subject to the approval of the voters.

TAMPA, FLA. — The City Commission has appropriated $6,000 for extension of the beacon light traffic signal system.

MONTEREY, TENN. — The Tennessee Electric Power Company, Chattanooga, is negotiating for the purchase of the property of the Monterey Light & Power Company. Extensions in transmission system are planned.

WHITEVILLE, TENN. — The Memphis Power & Light Company plans to extend its transmission lines to Whiteville, where it has been awarded a contract to furnish electricity.

ANDALUSIA, ALA.—Extensions and improvements are contemplated by the Andalusia Light & Power Company, recently reorganized.

LITTLE ROCK, ARK. — The Justin Matthews Company, 121 West Second Street, plans to erect an electric transmission line, about 7 miles, for service in a property subdivision now being developed for residential purposes.

PRAIRIE GROVE, ARK. — The City Council has contracted with the Southwest Power Company, McAlester, Okla., for the installation of new lighting system.

BERWICK, LA.—The proposal to sell the municipal electric plant to the Louisiana Public Service Company, Franklin, will be submitted to the voters at an election to be held July 1.

NEW ORLEANS, LA.—Bids will be received at the office of the supervising office, Treasury Department, Washington, D. C., until July 14 for furnishing a storage battery, etc., at the United States quarantine station, New Orleans. For details see Searchlight Section.

CUERO, TEX.—Preparations are being made by Texas Central Power Company, San Antonio, for the erection of a transmission line from Gonzales to Cuero and to extend its line from Nordheim to Kenedy. The company is now building a power house at Gonzales and plans to construct another dam in this vicinity soon.

GUTHRIE, OKLA. — Preliminary plans are being prepared for the installation of a 200-hp. oil engine-driven generator unit in the waterworks plant, to cost about $30,000. W. I. Mathis, 411 East Oklahoma Street, is engineer.

LONGVIEW, TEX.—The Eastern Texas Public Service Company, Beaumont, is considering the construction of a transmission line from Marshall, for local light and power service.

TAYLOR, TEX.—Arrangements are being made by the Texas Power & Light Company, Dallas, to extend its transmission system from Taylor to San Marcos, a distance of about 65 miles. It plans to serve a number of towns along the line.

Pacific and Mountain States

CHEHALIS, WASH.—The Puget Sound Power & Light Company is planning to erect a transmission line along the Pacific Highway to furnish service to the Newaukum Valley district south and east of Chehalis. The cost is estimated at $11,000.

LONGVIEW, WASH. — The Longview Public Service Company plans to erect a substation at 1168-72 Tenth Avenue.

TACOMA, WASH.—Bids will be received by the Commissioner of Light and Water until July 10 for the installation of a power-line duplex carrier telephone system.

YAKIMA, WASH.—The Pacific Power & Light Company, Portland, Ore., contemplates extending its transmission line along Washington Avenue to the Ahtanum Ridge.

AZUSA, CAL.—At a special election held recently the proposal to issue $10,000 in bonds for a municipal lighting system was defeated.

LOS ANGELES, CAL.—Bids will be received by the Public Service Commission, 207 South Broadway, until July 3 for 35,000-volt cables (Specification P-356). James P. Vroman is secretary.

LOS ANGELES, CAL.—The Bureau of Power & Light, Department of Public Service, 207 South Broadway, plans to construct a two-story equipment storage and distributing plant at 611 North Hoover Street, to cost about $100,000.

LOS ANGELES, CAL.—The City Council has adopted ordinances for the installation of an ornamental lighting system on portions of Kenmore Avenue, Thirty-fourth Street, and on Fourth Avenue.

PASO ROBLES, CAL.—Improvements to its local system, to cost about $25,000, is under consideration by the Midland Counties Public Service Corporation, San Luis Obispo.

SAN GABRIEL, CAL.—The City Council has authorized plans for the installation of an ornamental lighting system on Brad Lury Drive and Rosemont Boulevard, and adjoining streets, using concrete standards.

SOUTH GATE, CAL.—The City Council is considering the installation of ornamental lamps on Manchester Avenue, using metal standards.

LEWISTON, IDAHO.—Plans for the proposed cement mill to be built by the Idaho Cement Company on Mission Creek, to cost about $1,000,000, include a power plant.

ORCHARD, IDAHO.—The Idaho Power Company plans to build a substation in Orchard.

COLORADO SPRINGS, COL.—The City Council has appropriated $10,000 for the erection of a transmission line between Manitou and Ruxton Park.

Electrical Patents

Announced by U. S. Patent Office

(Issued May 26, 1925)

1,538,952. TRAFFIC SIGNAL; A. W. Ram, Washington, D. C. App. filed June 29, 1921.

1,538,959. MULTIPLE FUSE AND FUSE HOUSING; J. Teipel and W. F. Exner, St. Louis, Mo. App. filed Oct. 26, 1922.

1,538,960. ALTERNATING-CURRENT RELAY; E. O. Thompson, Tompkinsville, N. Y. App. filed July 19, 1922.

1,538,964. WAVE FILTER; O. J. Zobel, New York, N. Y. App. filed Jan. 15, 1921.

1,538,972. ELECTRIC HEATER; O. Conradty, Nuremberg, Germany. App. filed Feb. 17, 1925. Connecting contact for electric heating rods.

1,538,986. CIRCUIT INTERRUPTER; T. T. Greenwood, Templeton, Mass. App. filed Sept. 1, 1922. For high-capacity oil-immersed electric switches.

1,538,992. FLASHLIGHT AND RECHARGING DEVICE FOR THE BATTERY THEREOF; N. M. Hopkins, New York, N. Y. App. filed Dec. 20, 1920.

1,539,004. SYSTEM OF ELECTRIC CURRENT DISTRIBUTION; C. A. Turner, Madison, Wis. App. filed May 26, 1924.

1,539,039. WATER HEATER; J. E. Blanding, New London, Conn. App. filed Nov. 20, 1922. Instantaneous type.

1,539,044. ALTERNATING-CURRENT WELDING APPARATUS; R. E. Frickey, San Francisco, Cal. App. filed July 18, 1921.

1,539,068, 1,539,069. HANDLE FOR MOTOR HAND TOOLS; Bluford W. Brockett, Cleveland Heights, Ohio. App. filed Jan. 29, 1923.

1,539,104. SWITCH; J. A. Amos, St. Louis, Mo. App. filed April 29, 1922. Electric switch and associated plug receptacle.

1,539,105. SIGNAL LANTERN; J. A. Amos, St. Louis, Mo. App. filed March 17, 1924. As used by train men for signaling.

1,539,132. AUTOMATIC TELEPHONE SYSTEM; T. G. Martin, Chicago, Ill. App. filed March 15, 1921.

1,539,150. RECEIVING DETECTOR FOR WIRELESS TELEGRAPHY; O. Von Bronk, Berlin, Germany. App. filed Sept. 3, 1921.

1,539,152. ELECTRIC SWITCH; R. B. Benjamin, Chicago, Ill. App. filed Sept. 29, 1919. Pull snap-switch sockets.

1,539,158. TRANSMITTER FOR MULTIPLEX ALTERNATING-CURRENT TELEGRAPHY; A. Clausing, Berlin-Charlottenburg, Germany. App. filed Sept. 9, 1922.

1,539,168. MOTOR-CONTROL SYSTEM; C. A. Dresser, New York, N. Y. App. filed June 7, 1923. For motors driving large printing presses and like machines.

1,539,204. TIME SWITCH; J. Salvador Prowense, Kansas City, Mo. App. filed Jan. 27, 1923.

1,539,232. ROTOR; J. M. Barr, Milwaukee, Wis. App. filed Feb. 18, 1922. Core provided with a winding having integral conductors and end rings.

1,539,241. SPARKLESS COMMUTATION; U. Cantutti, Rome, Italy. App. filed June 5, 1923.

1,539,276. ELECTRIC WAFFLE IRON; G. E. Savage, Meriden, Conn. App. filed Oct. 25, 1924.

1,539,293. COMBINED THERMOSTATIC CIRCUIT CLOSER AND SPRINKLER; W. T. Bridges, Lafayette, Ga. App. filed June 10, 1922.

1,539,316. POLE SWITCH; O. Jacobson, Stockholm, Sweden. App. filed May 3, 1923.

1,539,359. SWITCH-ACTUATING DEVICE; W. S. Kisinger and J. A. Ensley, Covington, Ky. App. filed Nov. 10, 1923. Applied to switches of the push-button type.

1,539,380. TELEPHONE-EXCHANGE SYSTEM; S. B. Williams, Brooklyn, N. Y. App. filed Dec. 5, 1922. Automatic switching.

1,539,385. BATTERY PLUG; W. H. Ellis, Two Rivers, Wis. App. filed March 23, 1923. Fused.

1,539,390. METHOD OF AND MEANS FOR TRANSLATING SOUNDS; R. E. Hall, Rock Island, Ill. App. filed May 8, 1922.

1,539,402. MEANS FOR PRODUCING ELECTRICAL OSCILLATIONS; H. W. Nichols, Maplewood, N. J. App. filed Feb. 24, 1919.

1,539,404. MULTIPLE FUSE; H. Nothdurft, Richmond Hill, N. Y. App. filed May 2, 1924.

1,539,406. GENERATOR; L. M. Perkins, Syracuse, N. Y. App. filed Jan. 3, 1921. Variable-speed third-brush type.

1,539,419. OZONE-GENERATING UNIT AND METHOD OF REGULATING THE AIR GAP THEREIN; W. Keiser, St. Louis, Mo. App. filed Aug. 6, 1923.

1,539,421. ELECTRIC COMMUNICATING SYSTEM; C. Kraft, New York, N. Y. App. filed July 6, 1920.

1,539,427. BATTERY; T. M. Rector, Rutherford, N. J. App. filed May 10, 1924. Dry-cell type; means for preventing deterioration.

1,539,429. OVERLOAD-CIRCUIT BREAKER FOR MOTORS STARTED BY MEANS OF A STARTING RESISTANCE; W. Sartig, Essen, Germany. App. filed March 10, 1922.

1,539,451. CIRCUIT BREAKER; W. N. Willis, Easton, Md. App. filed June 23, 1923. High-tension.

1,539,464. ELECTROMAGNETIC WAVE RECEIVING AND AMPLIFYING SYSTEM; F. J. Chambers, London, England. App. filed Dec. 13, 1922.

1,539,465. FIELD REGULATOR; P. I. Chandeysson, St. Louis, Mo. App. filed May 25, 1922. For automatic regulation of electric generators.

1,539,484. ELECTRIC LAMP-SUPPORTING STRUCTURE; M. Herskovitz, Chicago, Ill. App. filed Jan. 21, 1922.

1,539,490. MANUFACTURE OF ELECTRIC CABLES; P. V. Hunter, London, England. App. filed Dec. 13, 1922.

1,539,497. ELECTRICAL HEATING DEVICE; A. Longoria, Cleveland, Ohio. App. filed March 27, 1922. Table stove.

1,539,499. COIL-WINDING MACHINE; T. E. Moldon, Toronto, Ontario, Canada. App. filed July 11, 1923.

1,539,504. CONNECTION PLUG; F. E. Petri, Peoria, Ill. App. filed Feb. 4, 1924.

1,539,527. ELECTRIC GENERATOR; J. W. Torrance and J. McK. Torrance, Failsworth, England. App. filed June 13, 1921. For the electric lighting of vehicles.

1,539,559. WATER-TIGHT RECEPTACLE AND PLUG THEREFOR; R. B. Benjamin, Chicago, Ill. App. filed Aug. 7, 1918.

1,539,545. CIGAR LIGHTER AND THE LIKE; C. H. Cuno, Meriden, Conn. App. filed July 29, 1924.

1,539,562. ELECTRIC HEATER; H. Herrmann, Berlin, Germany. App. filed June 13, 1924. Having the control switch separate from the main leads.

1,539,571. ELECTRIC MOTOR; J. T. Janette, Chicago, Ill. App. filed Nov. 9, 1921. Means for short-circuiting the commutator bars of a repulsion-induction motor.

1,539,605. ELECTRIC FLATIRON; A. H. Simmons, Oak Park, Ill. App. filed May 2, 1923.

1,539,620. BURGLAR AND FIRE ALARM; W. M. Wossoff, Merchantville, N. J. App. filed June 11, 1920.

1,539,621. CIRCUIT-CONTROLLING DEVICE; E. G. Acker, New York, N. Y. App. filed Feb. 5, 1921. Used in conjunction with signs.

1,539,635. THERMOSTATIC CIRCUIT CLOSER; J. M. Biggs, Helena, Ark. App. filed Oct. 31, 1921.

1,539,640. MAGNETIC SEPARATOR; E. H. Brune, St. Louis, Mo. App. filed July 21, 1924.

1,539,658. PROTECTIVE APPARATUS; A. S. Fitz Gerald, Finchley, England. App. filed May 23, 1924.

1,539,662. ELECTRIC ALTERNATING-CURRENT MACHINE; H. Frei, Oberengstringen, near Zurich, Switzerland. App. filed Feb. 13, 1922. Having three sets of field magnets.

1,539,670. STATIONARY INDUCTION APPARATUS; A. B. Hendricks, Jr., Pittsfield, Mass. App. filed Feb. 24, 1920.

1,539,672. ELECTRIC LIGHT INSTALLATION FOR ALTERNATING CURRENT; G. Holst, Eindhoven, Netherlands. App. filed Sept. 29, 1920.

1,539,684. TIMING DEVICE; F. S. Marcellus and J. J. Powers, Schenectady, N. Y. App. filed Sept. 7, 1923.

1,539,690. STROBOSCOPIC DEVICE; C. A. Nickle, Schenectady, N. Y. App. filed Aug. 7, 1924.

1,539,692. ELECTRICAL STEAM GENERATION; T. H. Noll, New York, N. Y. App. filed Aug. 31, 1923.

1,539,703. ELECTRIC FURNACE; L. Tagliaferri, Genoa, Italy. App. filed Oct. 17, 1922.

1,539,723. ELECTRICAL CONNECTION AND METHOD OF MAKING THE SAME; C. A. Deuscher, New York, N. Y. App. filed Aug. 19, 1922.

1,539,734. ELECTRIC HEATER; J. Hauber, Melrose Park, Ill. App. filed March 15, 1924. For domestic use.

1,539,810. WELDING ELECTRODE; R. T. Gillett, Schenectady, N. Y. App. filed July 30, 1924.

1,539,812. NON-SATURATING INDUCTION RELAY; C. I. Hall, Fort Wayne, Ind. App. filed Jan. 22, 1923.

1,539,813. DEFINITE-PICK-UP INDUCTION RELAY; C. I. Hall, Fort Wayne, Ind. App. filed March 15, 1923.

(Issued June 2, 1925)

1,539,819. SNAP SWITCH; C. Aalborg, Pittsburgh, Pa. App. filed Aug. 30, 1920. Toggle type.

1,538,820, 1,539,821, 1,539,822. WAVE SIGNALING SYSTEM; E. H. Armstrong, Yonkers, N. Y. App. filed June 8, 1922.

1,539,834. SAFETY SYSTEM FOR ALTERNATING-CURRENT GENERATORS; W. Gaarz, Berlin-Charlottenburg, Germany. App. filed Feb. 3, 1925.

1,539,837. TRANSFORMER COOLING SYSTEM; S. Q. Hayes, Pittsburgh, Pa. App. filed Aug. 15, 1919.

1,539,839. INDUCTION-MOTOR CONTROL SYSTEM; R. E. Hellmund, Swissvale, Pa. App. filed March 23, 1919. For effecting the dynamic braking of induction motors by applying direct-current excitation to the primary windings of the motor.

1,539,840. TRANSFORMER; P. M. Hengstenberg, Wilkinsburg, Pa. App. filed May 26, 1923. Magnetic characteristics may be very finely adjusted.

1,539,847. SWITCHBOARD STRUCTURE; W. H. Kempton, Wilkinsburg, Pa. App. filed July 13, 1922.

1,539,851. SNAP SWITCH; H. K. Krantz, Brooklyn, N. Y. App. filed Sept. 24, 1920. Toggle type.

1,539,852. REGULATOR SYSTEM; E. F. Lehr, Wilkinsburg, Pa. App. filed Sept. 16, 1921. Step by step type.

1,539,864. CIRCUIT INTERRUPTER SYSTEM; A. J. A. Peterson and F. B. Kniskern, Wilkinsburg, Pa. App. filed March 13, 1924.

1,539,866. TELEPHONE SYSTEM; A. E. Reinke, The Hague, Netherlands. App. filed Nov. 26, 1920. Private branch exchange system.

1,539,870. ELECTRIC CUT-OUT; M. J. Sandin, Wilkinsburg, Pa. App. filed June 17, 1920. Renewable fuse with time-limit characteristics.

1,539,871. PANTOGRAPH TROLLEY; W. Schaake, Pittsburgh, Pa. App. filed Nov. 7, 1922.

1,539,872. MOTOR-CONTROL SYSTEM; S. B. Schenck, Edgewood Park, Pa. App. filed June 3, 1921. For railway vehicle.

1,539,878. TRANSFORMER BRACING; M. E. Skinner, Wilkinsburg, Pa. App. filed May 12, 1919.

1,539,880. SURGE-DETECTING RELAY; H. P. Sparkes, Pittsburgh, Pa. App. filed May 24, 1923.

1,539,885. ELECTRICAL CONTROL APPARATUS; E. H. Thompson, New Kensington, Pa. App. filed Dec. 10, 1921.

1,539,888. METHOD AND MEANS FOR MEASURING CURRENT DISTRIBUTION; C. F. Wagner, Pittsburgh, Pa. App. filed Jan. 14, 1921. In busbars.

1,539,891. MAGNETIC LIFTING DEVICE; A. D. Wood, Philadelphia, Pa. App. filed Aug. 9, 1920.

1,539,902. CARRIER TRANSMISSION OVER POWER CIRCUITS; R. K. Honaman, Bloomfield, N. J. App. filed April 29, 1924.

Financial and Corporate

Market Turns Irregular

Trading Assumes More Moderate Tone as Big Board Activities Give Signs of Dullness

THE behavior of the market in power and light stocks has become very similar in many ways to that in the general run of issues. Easy money continues to be the dominant factor in the trading for a good many groups at a time of year when the industry does not ordinarily expect much activity either in the field or at the central securities markets. In utilities as in stocks of other groups sharp advances nowadays are being made by selected issues, but on the same days other good stocks are selling off. The market is irregular.

Absence of the delegates in attendance at the San Francisco convention tended to make the week somewhat quieter perhaps than otherwise it might have been. The convention has centered attention, however, upon electrical refrigeration. Incidentally, the warm response to the movement for refrigeration is coming to be recognized as one of the leading bull points on power and light stocks, and of course investors are taking a fresh interest in the stocks of the electrical refrigeration companies. Special activities of late have developed, for example, in Serv-el Corporation.

The outstanding gains of the week were those made in General Gas & Electric and in Mississippi River Power, although in neither case did the advance come as the result of a very large volume of trading. The former added seventeen points to its position of the week before and the latter added twenty-one points. Montana Power on the big board has become stronger as a result of talk of electrification for the Great Northern. On the other hand, losses of several points for the week were registered by Commonwealth Power Corporation, Adirondack, Electric Bond & Share, National Power & Light and Southeastern.

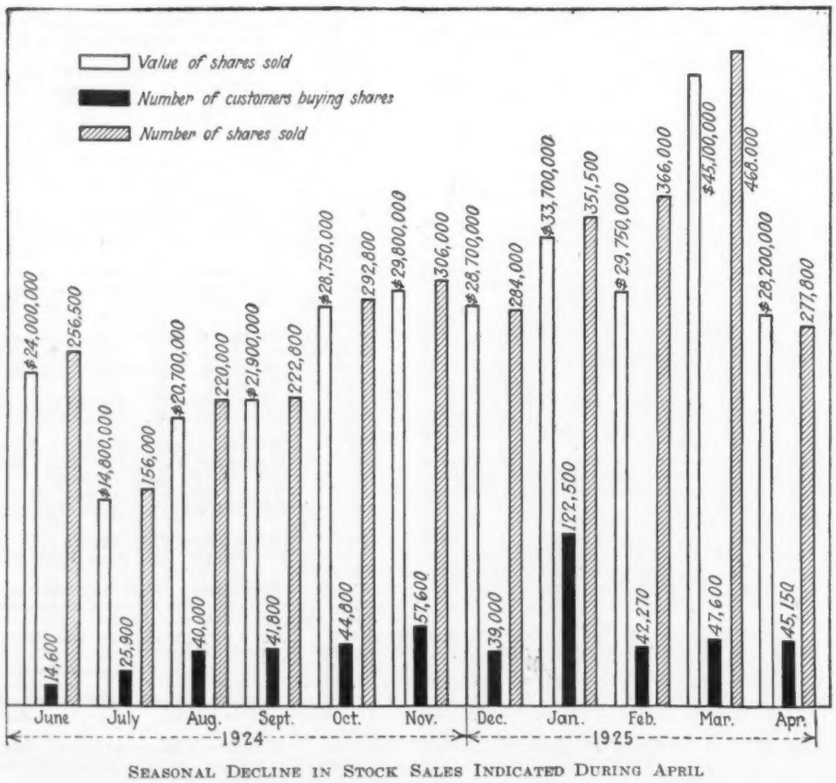
Company Reports

The following statements of earnings were issued during the past week by electric light and power companies for the month of May:

Name of Company	Gross Earnings for May 1925	1924
Adirondack Power & Light	$640,478	$558,970
Alabama Power	868,030	699,600
Cities Service	1,960,820	1,855,491
Grafton County El. Lt. & Pwr.	16,219	15,173
Public Service Corp. of N. J.	7,605,968	7,084,533
Republic Railway & Light	890,485	879,278
Virginia Railway & Power	870,494	858,612

April Customer Ownership Sales Total $28,200,000

Based upon monthly reports received by the ELECTRICAL WORLD from electric light and power companies selling stock direct to customers and employees, it is estimated that during April a total of 277,800 shares were sold in this manner. The total value of this stock is estimated at $28,200,000, and a total of 45,150 customers participated in the sales. The average sale to each customer was $625.



SEASONAL DECLINE IN STOCK SALES INDICATED DURING APRIL

Iowa Utilities Consolidate

The Sioux City Gas & Electric Company, a subsidiary of the United Gas Improvement Company, which does the entire electric light, power and gas business in the city of Sioux City, Iowa, has contracted to acquire all of the common stock of the Iowa Light, Heat & Power Company. The properties of the Iowa Light, Heat & Power Company, which are absorbed in this consolidation, include 582 miles of high-tension transmission line, serving eighty-two cities and towns, including Storm Lake, Rock Valley, Mapleton, Le Mars, Audubon, Manning, Sac City, Sheldon, Rockwell City and Kingsley. The properties of the Iowa organization have been interconnected with the transmission lines of the Sioux City Gas & Electric Company, and all of the properties will be under unified direction and management.

The following statement was made by W. J. Bertke, vice-president and general manager:

"In view of the completion of the new power plant of the Sioux City Gas & Electric Company in the near future it has been found desirable and advisable to consolidate the properties of the Iowa Light, Heat & Power Company with those of the Sioux City Gas & Electric Company. The Iowa Light, Heat & Power Company will retain its separate legal entity as hitherto."

Stone & Webster Organize New Utility Company

Stone & Webster and other members of the syndicate which recently bought control of the Virginia Railway & Power Company from Frank J. Gould, as already announced in the ELECTRICAL WORLD, have formed a new company in Delaware to be known as the Engineers' Public Service Company. The new organization, which will acquire the Virginia Railway & Power Company and other properties in the same territory, will have a capitalization of 1,400,000 shares, including 400,000 preferred shares without nominal or par value and 1,000,000 common shares without nominal or par value. A public offering of 200,000 shares of the preferred has been made in the form of allotment certificates, priced at $100 and carrying one-half share of common stock for each certificate.

New Capital Issues—During the past week the Catskill Power Corporation floated an issue of first mortgage 5½ per cent gold bonds totaling $2,500,000

at 95 and interest yielding over 5.85 per cent. These bonds were dated May 1, 1925, and mature May 1, 1955. The El Paso Electric Company was represented with a $3,000,000 offering of first mortgage gold bonds priced at 95¾ and accrued interest, to yield about 5.30 per cent.

United Light & Power in Limelight

Its Absorption on Two Occasions of Properties Larger than Itself, Raising Earnings to $35,000,000, Centers Interest Upon Securities

BY PAUL WILLARD GARRETT

MUCH has been said about the acquisition of the Continental Gas & Electric Corporation by the United Light & Power Company, soon after the Continental had itself secured control of both the Kansas City Power & Light Company and the Columbus Railway, Power & Light Company. By this extraordinary move the United Light & Power, for the second time in its history, acquired a group of properties larger than itself. Not so much has been said, however, about the earlier history of the company during which the management concentrated attention upon the building up of properties already in the group.

During its two decades of development prior to January 1, 1924, United Light devoted its energy to inward improvements, a thing that should be considered by those who think they see dangers in the recent rapid moves toward expansion. Gross earnings considerably more than doubled during the second decade—that is, from January, 1914, to January, 1924—but not a dollar in that whole period was spent for expansion outside of the utility's own field. Operations were nowhere swelled by the purchase of other properties.

As it is organized today the United Light & Power Company controls four rather important groups of properties, known as (1) the Iowa-Illinois group, (2) the Nebraska group, (3) the Missouri group and (4) the Ohio group. Prior to the recent acquisition the old United Light & Power served such centers as Davenport and Cedar Rapids, Iowa; Rock Island and Moline, Ill.; Laporte, Ind., and Chattanooga, Tenn. Among the more important cities added to this list by the new acquisitions must be mentioned Kansas City, Mo.; Columbus, Ohio, and Lincoln, Neb.

As might be expected from a utility which serves places of this character, United Light & Power's business has grown in an impressive manner over the last five years. Gross earnings for example have increased from $20,883,110 in 1919 to $34,959,842 for the twelve months ended April 30, 1925. Net earnings in the same period have grown from $5,419,500 to $14,452,411.

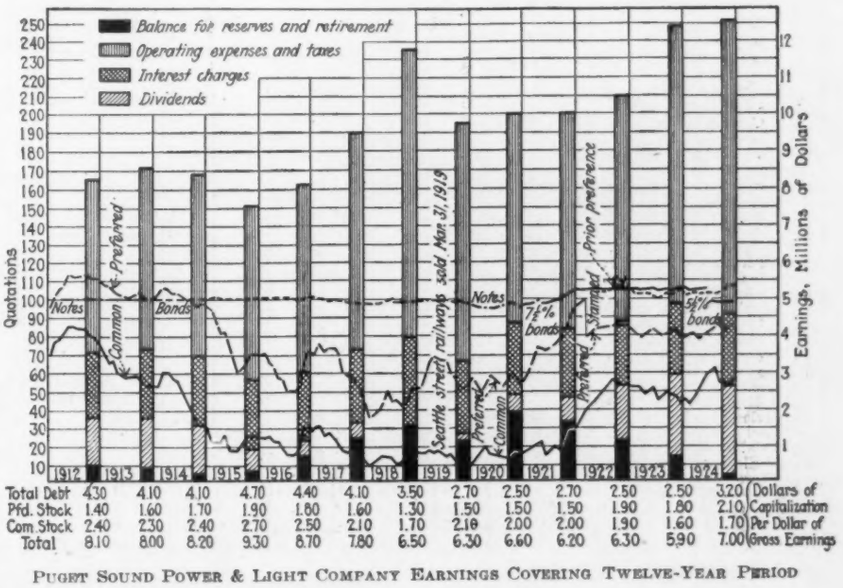
Deduction of $3,903,344 as interest of the subsidiary companies due to the public and of $2,508,317 as dividends due to the public and net earnings attributable to common stock not held by the company leaves $8,040,749 as the gross income available for the United Light & Power Company for the twelve months ended April 30, 1925. Fixed charges took $2,394,823 and preferred stock dividends $1,019,442, leaving $4,626,484 as the surplus available for amortization, depreciation and common-stock dividends. Earnings have increased to a point at present where, according to reports, United Light & Power is showing net earnings at the rate of about $7 or $8 a year on its common stock.

The rapid growth and improvement of the United Light & Power system is being watched closely by the same financial authorities who sometimes look with misgivings upon holding companies once or twice removed from the operating properties. While United Light & Power as to numerous of its properties stands in very close relation, its contact with Kansas City Power & Light and Columbus Railway, Power & Light is derived, of course, by reason of its control over the Continental Gas & Electric Corporation.

Earnings of the Puget Sound Company

The accompanying chart from the annual report of the Puget Sound Power & Light Company for the year 1924 shows graphically year by year the earnings of the company, the relation of these earnings each year to the outstanding capital and the resulting effect upon security values as reflected in market quotations.

The report contains some interesting statistics covering the operating conditions of the company during the past year. The number of customers served advanced from 92,527 in 1923 to 102,014 in 1924. The amount of electrical energy generated and purchased in 1924 totaled 607,067,000 kw.-hr. as compared with 577,578,000 kw.-hr. in 1923 and 474,043,000 kw.-hr. in 1922.


Balance for reserves and retirement
Operating expenses and taxes
Interest charges
Dividends
Quotations
Earnings, Millions of Dollars
Notes
Common & Preferred
Bonds
Seattle street railways sold Mar. 31, 1919
Preferred & Common
Notes
7½% bonds
Preferred
Common
5½% bonds
1912 1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924
Total Debt 4.30 4.10 4.10 4.70 4.40 4.10 3.50 2.70 2.50 2.70 2.50 2.50 3.20 Dollars of
Pfd. Stock 1.40 1.60 1.70 1.90 1.80 1.60 1.30 1.50 1.50 1.50 1.90 1.80 2.10 Capitalization
Com. Stock 2.40 2.30 2.40 2.70 2.50 2.10 1.70 2.10 2.00 2.00 1.90 1.60 1.70 Per Dollar of
Total 8.10 8.00 8.20 9.30 8.70 7.80 6.50 6.30 6.60 6.20 6.30 5.90 7.00 Gross Earnings

PUGET SOUND POWER & LIGHT COMPANY EARNINGS COVERING TWELVE-YEAR PERIOD

Dividends Declared

The quarterly dividends listed below were announced during the past week by electric light and power companies and electrical manufacturing companies:

Name of Company	Per Cent	When Payable
Adirondack Power & Light, 7%pf.	1¾	July 1
Adirondack Power & Light, 8% pf.	2	July 1
Arkansas Central Power, pf.	$1.75	July 1
Buffalo General Electric	.40	June 30
Central Illinois Light, 6% pf.	$1.50	July 1
Central Illinois Light, 7% pf.	$1.75	July 1
Central Power (Neb.) pf.	1¾	July 15
Central Power & Light, pf.	$1.75	Aug. 1
Cities Service, com*	½	Aug. 1
Cities Service, com.†	½	Aug. 1
Cities Service, pf. and pf. B*	½	Aug. 1
Coast Valleys Gas & Elec., pf. A	1½	June 30
Coast Valleys Gas & Elec., pf. B	1½	June 30
Commonwealth Power, 6% pf.	$1.50	Aug. 1
Commonwealth Power, com.	$1.50	July 20
Consumers Power, 6 per cent, pf.	$1.50	Oct. 1
Consumers Power, 6.6 per cent, pf.	$1.65	Oct. 1
Consumers Power, 7 per cent, pf.	$1.75	Oct. 1
Consumers Power, 6 per cent, pf.*	.50	Aug. 1
Consumers Power, 6 per cent pf.*	.50	Sept. 1
Consumers Power, 6 per cent, pf*	.50	Oct. 1
Consumers Power, 6.6 per cent, pf*	.55	Aug. 1
Consumers Power, 6.6 per cent, pf*.	.55	Sept. 1
Consumers Power, 6.6 per cent, pf*.	.55	Oct. 1
Eastern Kansas Power, pf.	1¾	July 1
El Paso Electric, pf., A	1¾	July 15
El Paso Electric, pf., B	1¾	July 15
Greenfield Elec. Light & Power, com.	2½	June 30
Greenfield Elec. Light & Power, pf.	.25	June 30
Harrisburg Light & Power, pf.	1¾	June 30
Illinois Northern Utilities, pf.	1¾	Aug. 1
Illinois Power, 6 per cent, pf.	1½	July 1
Illinois Power, 7 per cent, pf.	1¾	July 1
Kansas Electric Power, pf.	1¾	July 1
Memphis Power & Light, pf.	$1.75	July 1
Middle West Utilities, pf.	$1.75	July 15
Midland Utilities, pf.	1¾	July 6
Montreal Lt., Ht. & Pwr., Consol.	2	Aug. 15
Montreal Light, Heat & Power	2	Aug. 15
Narragansett Electric Light	$1	July 1
Northern Indiana Gas & Elec., pf. A	1¾	July 14
Ohio, River Edison, pf.	1¼	July 1
Puget Sound Power & Light, com.	1	July 15
Puget Sound Power & Light, prior pf.	1¾	July 15
Puget Sound Power & Light, pf.	1¾	July 15
So. Indiana Gas & Elec., 6% pf‡	$3	July 1
So. Indiana Gas & Elec., 7% pf.	$1.75	July 1
Tennessee Electric Power, 2d pf.	$1.50	Aug. 1
Turners Falls Power & Electric	1¾	June 30
United Gas & Electric, pf.	1¾	July 1
Virginia Railway & Power, pf.	1¾	July 20
Washington Railway & Elec., com.	$20	July 1
Washington Water Power	2	July 15
West Penn Power, 7 per cent, pf.	1¾	Aug. 1
Western Power, pf.	1¾	July 15
Black & Decker Mfg., com. & pf.	2	June 30
Johns-Manville, Inc.	.75	July 1
Philadelphia Insulated Wire	$2	Aug. 1

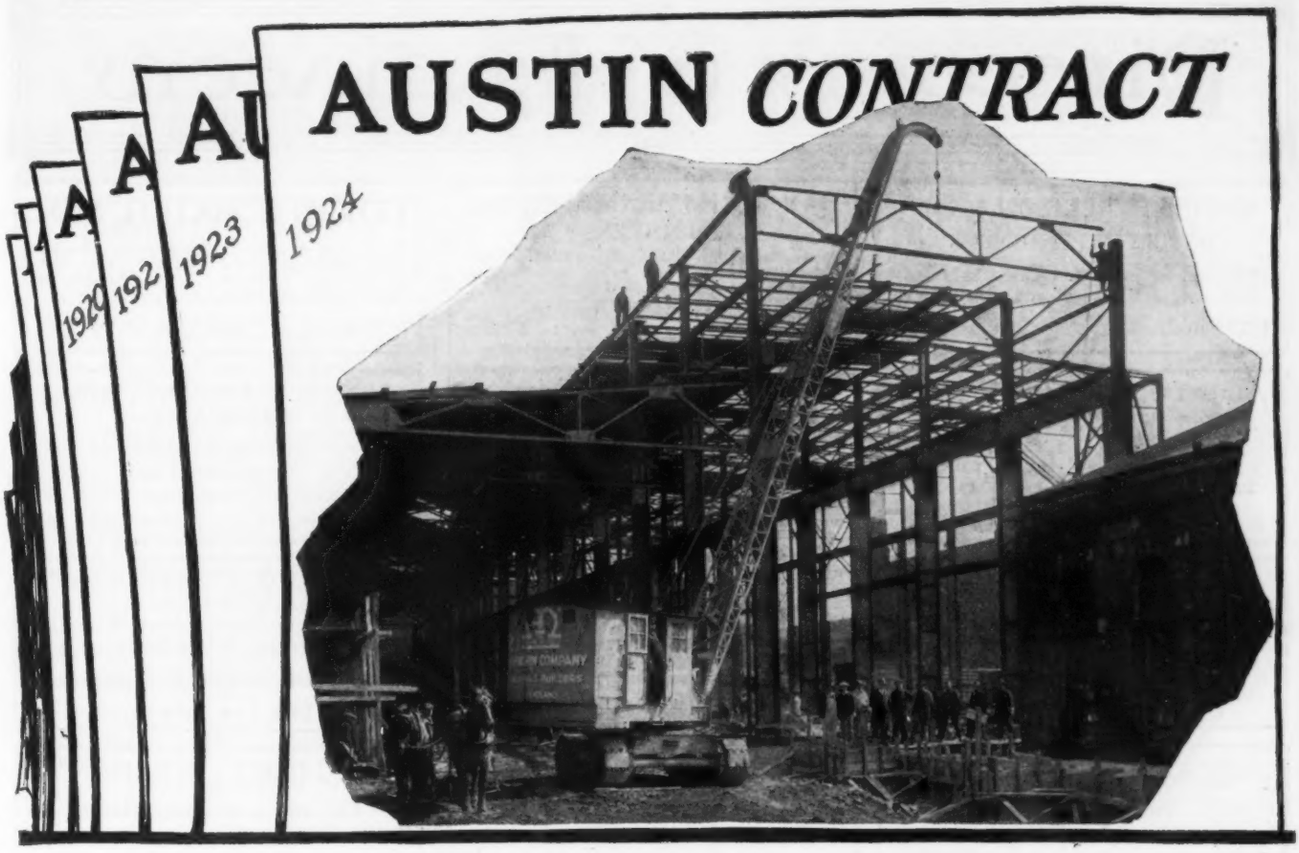
* Monthly. † In common stock. ‡ Semi-annual.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stocks is $100.)

Companies	Bid Price Saturday, June 20	Low 1925	High 1925
PREFERRED STOCKS			
Operating Companies			
Adirondack Power & Light 7 per cent	102	98	106
Appalachian Power, 7 per cent	99	92	100
Arkansas Light & Power 7 per cent	96	92	98
Asheville Power & Light 7 per cent	a100	100	101
Central Illinois Public Service 6 per cent	86	84	93
Colorado Power 7 per cent	94	93	98
Connecticut Light & Power 7 per cent	106	105	110
Consumers' Power 6 per cent	94	90	97
Dayton Power & Light 6 per cent	96	88	100
Duquesne Light 7 per cent	110½	105	111¾
Eastern Texas Electric 6 per cent	100	100	105
Empire District Electric 6 per cent	78	78	85
Fort Worth Power & Light 7 per cent	a101½	101½	103
Great Western Power 7 per cent	100½	...	...
Illinois Northern Utilities 6 per cent	88	82	92
Illinois Power & Light 7 per cent	95	92½	98
Kansas Gas & Electric 7 per cent	a100	100	101
Long Island Lighting 7 per cent	102	100	105
Minnesota Power & Light 7 per cent	a 99	99	101
Mississippi River Power 6 per cent	90	87½	92
Nebraska Power 7 per cent	a101	101	103
Niagara Falls Power 7 per cent—25	28½	28	29
Niagara, Lockport & Ont. Power 7 per cent	109	101½	110
Northern States Power 7 per cent	98½	95	100
Ohio Public Service 7 per cent	98½	97	100
Pacific Gas & Electric 6 per cent	95½	92	97
Pacific Power & Light 7 per cent	a100	100	101
Penn-Ohio Power & Light 7 per cent	94	91	100
Pennsylvania Power & Light $7—no par	a102	102	104
Penn. Public Service 7 per cent	90	90	100
‡Philadelphia Electric 8 per cent—25	39½	37½	45
Southern California Edison 8 per cent	125	115	122
Southern California Edison 7 per cent	107	105	107½
Southern California Edison 6 per cent	93½	90	94½
Tennessee Electric Power, 6 per cent	82	80	84
Texas Power & Light 7 per cent	a101½	101½	103
Utah Power & Light 7 per cent	a100½	100½	101½
Western States Gas & Electric 7 per cent	89	82	92
Yadkin River Power, 7 per cent	a101	101	102
Holding Companies			
American Gas & Electric 6 per cent—no par	89	85	90
American Light & Traction	99	93	100
American Power & Light 6 per cent	90	84	90
American Public Service 7 per cent	91	88	94
American Public Utilities 7 per cent	87	87	95
American Water Works & Electric 7 per cent	a101½	100	103
Associated Gas & Electric 7 per cent—1 per cent extra—50	a 52	...	...
Associated Gas & Electric—$6—no par	84	...	...
Carolina Power & Light $7—no par	104	100	105
Central Indiana Power 7 per cent	89	88	95
Cities Service 6 per cent	82	80	83
Commonwealth Power 6 per cent	82	80	85½
Continental Gas & Electric 7 per cent pr. pf.	92	89	95
Electric Bond & Share 6 per cent	a104½	103½	105½
General Gas & Electric—$8—no par	114	104½	116
*Middle West Utilities 7 per cent	98	91½	98¾
National Power & Light—$7—no par	100½	95	99
North American 6 per cent—50	a 49½	46½	50½
Public Service Corp. of N. J. 7 per cent	99½	99	102½
Public Service Corp. of N. J. 8 per cent	114	108½	114¾
United Light & Power—$6.50—no par	92	83	89
COMMON STOCKS			
Operating Companies			
Adirondack Power & Light—50	85	31	93
Appalachian Power—no par	77½	70	83
Arkansas Light & Power	95	65	98
Brooklyn Edison	a135	120¾	140¾
Buffalo General Electric—no par (new)	65	44	69
*Commonwealth Edison	139½	130½	141¾
§Consolidated Gas, Electric Light & Power	41	32	44
Dayton Power & Light	420	180	460
Detroit Edison	a122½	110	125¾
|| Edison Electric Illuminating of Boston	211½	200	213
Long Island Lighting (new)	90	60	85
Mississippi River Power	49	37	50
Montana Power	a 82	64	87½
Niagara Falls Power—no par	68	45½	69
Niagara, Lockport & Ontario Power—no par	65	60	73
Northern Ohio Power	10	5	13½
Northern States Power	119	103	123
North Texas Electric	40	40	70
Pacific Gas & Electric	a115½	102½	118½
§Pennsylvania Water & Power	152½	126½	152½
‡Philadelphia Electric—25	40¾	37¾	47¾
Public Service Co. of Northern Illinois	122	97	124
Puget Sound Power & Light	51	49	61
Southern California Edison	117	102	120½
Tennessee Electric Power—no par	67	47	67
†Virginia Power	65	65	92
Virginia Railway & Power	a120	64½	123
West Penn. Co.	a135	105	145
Holding Companies			
American Gas & Electric—no par	77	70	85
American Light & Traction	165	139	172
American Power & Light	61	52	67
American Public Utilities	78	70	85
American Water Works & Electric	a 65½	34¾	68
Associated Gas & Electric, Class A	a 33¼	...	...
Carolina Power & Light	390	290	425
Cities Service (new)	38½	34	43
Columbia Gas & Electric—no par	a 65¾	45¾	69¾
Commonwealth Power Corp.—no par	160	106	168
Consolidated Gas—no par	a 87	74½	89½
Continental Gas & Electric	95	77	90
Electric Bond & Share Securities	a 67½	67	70½
Electric Power & Light	a 35½	17⅜	37½
Federal Light and Traction	a 34	30	36
General Gas & Electric	142	72	155
Lehigh Power Securities—no par	145	82	131
*Middle West Utilities—no par	95	82½	102½
National Power & Light—no par	323	185	335
North American—10	a 48½	41½	50⅜
Philadelphia Co.—50	a 58¼	51½	59⅞
Power Securities—no par	17	...	...
Public Service Corp. of N. J.—no par	a 68⅜	62⅜	74
Standard Gas & Electric—no par	a 52½	40½	54⅞
United Gas & Electric (Conn.)—no par	47	26	49
BONDS			
Operating Companies			
Adirondack Power & Light 6s	1950	105½	102½ 105½
Alabama Power 5s	1946	99½	96 100
Appalachian Power 5s	1941	99	96 99½
Brooklyn Edison 5s	1949	102½	99½ 103
6s	1930	105¼	104 105½
Cleveland Electric Illuminating 5s	1939	102	100 102
Commonwealth Edison 5s	1943	102	99½ 102
5s	1953	100½	98½ 101
§Consol. Gas, Elec. Lt. & Pwr. 4½s	1935	97½	93½ 97½
5½s	1949	107½	104¾ 107½
Consumers' Power 5s	1936	100½	99 100½
5s	1952	99½	90¾ 100
Detroit Edison 5s	1933	102½	99¾ 102½
Duquesne Light 6s	1949	106	104¾ 107¾
Great Western Power 5s	1946	98½	9⌀ 99
Kansas City Power & Light 5s	1952	100¾	95¾ 101
Mississippi River Power 5s	1951	99¼	96½ 100
Montana Power 5s	1943	100¼	97⅞ 100⅛
New England Power 5s	1951	102	100¼ 102
New York Edison 6½s	1941	115½	112 115½
Niagara Falls Power 6s	1932	106	103¾ 106½
Northern States Power 5s	1941	98⅜	93 99½
6s	1941	106½	103 107½
Ohio Power 7s	1951	106	106½ 107½
Pacific Gas & Electric 5s	1942	98¼	93½ 99
Pennsylvania Water & Power 5s	1940	101	99¾ 102
‡Philadelphia Electric 5s	1966	103½	100½ 103½
5½s	1953	106¼	104½ 107⅜
6s	1941	108	106 108⅛
Portland Electric Power 6s	1947	100	96½ 100
Southern California Edison 5s	1939	100	99½ 101
6s	1944	104½	102½ 104½
Tennessee Electric Power 6s	1947	103½	99½ 104½
Texas Power & Light 5s	1937	98½	97 99½
Toledo Edison 7s	1941	109¾	108½ 110
Utah Power & Light 5s	1944	98	91 98½
Holding Companies			
Alabama Traction, Light & Power 5s	1962	93½	86 95
American Gas & Electric 6s	2014	98	96½ 98½
American Power & Light 6s	2016	97	94 98
Amer. Water Works & Electric 5s	1934	96½	92½ 98
Associated Gas & Electric 6½s	1954	a102	... ...
Central Indiana Power 6s	1947	98½	95½ 98⅜
Commonwealth Power 6s	1947	101¼	97⅜ 103½
Consolidated Cities Lt., Pwr. & Tr. 5s	1962	80½	75½ 82½
Illinois Power & Light 6s	1953	102½	100½ 102½
United Light & Railways 5s	1932	96½	93½ 97
6s	1952	100	95½ 100½
ELECTRICAL MANUFACTURING COMPANIES			
PREFERRED STOCKS			
Allis-Chalmers Manufacturing		108	103¼ 108
Worthington Pump & Machinery A	a 82	79	88
COMMON STOCKS			
Allis-Chalmers Manufacturing	a 81½	71½	86⅛
American Bosch Magneto—no par	a 36½	26½	54½
Electric Storage Battery—no par	a 62⅜	60½	70¼
General Electric	a285	227½	320
General Electric—10	a 11½	11	11⅜
*Hurley Machine—no par	45½	41½	56
†Wagner Electric	37½	26½	50
Westinghouse Electric & Manufacturing—50	a 71½	66½	84
Worthington Pump & Machinery	a 38½	36¾	79¾
BONDS			
General Electric 3½s	1942	84½	83 84½
5s	1952	106	101½ 106½
Robbins & Myers 7s	1952	71	63½ 73¼
Western Electric 5s	1944	100½	98 101
Westinghouse Electric & Mfg. 7s	1931	107½	106½ 108½

*Chicago Stock Exchange. †St. Louis Stock Exchange. ‡Philadelphia Stock Exchange. || Boston Stock Exchange §Baltimore Stock Exchange.
a Bid price, low and high, Tuesday, June 23.



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in this paper offer a highly appropriate type of publicity for the services of professional men in the Electrical field.

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Professional Directory Department
ELECTRICAL WORLD
10th Ave., at 36th St., N. Y.

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E.W.

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ARMATURE winder to take charge of shop. Capable of handling all classes of shop work fans to large motors, alternating and direct. Must have sufficient business knowledge to interview customers and make prices. Must be sober, competent and reliable. A permanent position open only to a permanent man. Answer, stating age, where employed for last five years and guaranteed salary expected. Electric Supply Company, 210 21st St., Galveston, Texas.

COMPANY in the South desires to employ a competent switchboard engineer to estimate, design, and to assume full charge of their modernly equipped switchboard, panelboard, and steel cabinet factory. Applicants must advise in first letter complete details of experience, references, salary desired and earliest date available. P-495, Electrical World, 7 So. Dearborn St., Chicago, Ill.

FLORIDA: Competent man to take charge of coil winding department of electrical repair shop, must be thoroughly experienced and able to produce results. Reply, giving age, experience, wages expected and references. P-498, Electrical World, Real Estate Trust Bldg., Philadelphia, Pa.

SUPERINTENDENT of distribution or line foreman for electric utility in Southeast serving 6,000 customers. Must be thoroughly familiar with 2300-volt distribution. State age, education, experience, salary expected, and whether married or single. P-501, Electrical World, Real Estate Trust Bldg., Philadelphia, Pa.

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EXECUTIVES, engineers, find our individual, confidential service effective in making new connections. Personally conducted by Mr. Jacob Penn, the eminent employment authority, known to leading business men throughout America. Refund agreement protects you. Not agency. Jacob Penn, Incorporated, 305 Broadway, New York.

OVERTURES negotiated through the confidential correspondence service of the undersigned, for salaried positions $2,500 to $25,000—executive, mechanical, administrative, engineering, technical financial, manufacturing, sales, advertising, professional, etc., etc.; all lines. Established fourteen years; not an employment agency. Retaining fee refunded as provided in our "Refund Contract" if service is not satisfactorily rendered as per contract, and such refund be requested within three months from date remitted. Send name and address only for particulars. R. W. Bixby, Inc., 705 Lockwood Building, Buffalo, New York.

EMPLOYMENT AGENCY

INSTRUCTORS—Good college training or one to three years' experience either mechanical, electrical, and chemistry; also professors and assistant professors. Write fully giving experience in detail. H. H. Harrison & Co., Technical Teachers' Agency, 19 S. La Salle St., Chicago, Ill.

POSITIONS WANTED

AS electrical engineer, technical training, age 34, single; 11 years' experience with electric light companies. Possesses executive ability and is energetic. Wishes responsible position with holding company or utility, preferably in Middle West. Expect salary and opportunities commensurate with qualifications. Now employed. Best of references. Address PW-499, Electrical World, 7 So. Dearborn St., Chicago, Ill.

AS foreman or working foreman; 20 years' experience in switchboard and meter installations, general construction, steam, hydro and substation maintenance and operation; desires immediate position. PW-507, Electrical World, Leader-News Bldg., Cleveland, O.

CHIEF electrician or construction foreman; 8 years' experience in industrial, mining and public utility work on maintenance and construction. Technical training. Will go anywhere. Available at once. Best references. PW-497, Electrical World, Real Estate Trust Bldg., Philadelphia, Pa.

POSITIONS WANTED

CHANGE in ownership of public utility doing million and half dollars gross annually, will shortly release office manager and treasurer, a man with 10 years' experience with electric, gas and street railway. Competent to supervise all accounting, customers' billing and treasury matters. Eastern states or South preferred, but not essential. PW-500, Electrical World, Tenth Ave. at 36th St., New York.

DISTRIBUTION engineer or superintendent with Middle Western property preferred. Only positions of responsibility and executive nature considered. Technical training, age 34, now employed similar capacity as above. PW-492, Electrical World, 7 So. Dearborn St., Chicago, Ill.

DO you need a good executive? Electrical engineer, technical graduate, 9 years' experience in all phases central station work; age 37; married. Reply, PW-502, Electrical World, Leader-News Bldg., Cleveland, Ohio.

ELECTRIC arc welding engineer, college graduate, age 29; 7 years' experience a.c. and d.c. welding, machinery, electrodes, desires position. PW-490, Electrical World, Tenth Ave. at 36th St., New York.

ELECTRICAL engineer and accountant, college graduate with 3 years of practical engineering and office experience, desires position with future in valuation, industrial or commercial engineering. PW-484, Electrical World, 7 So. Dearborn St., Chicago, Ill.

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Central stations must have meter experts. Hundreds of competent men wanted for positions paying $3,000 and over. We can train YOU at home in your spare time.

BE A METER EXPERT

A postcard brings full details. No obligation.
FT. WAYNE CORRESPONDENCE SCHOOL
Dept. C, Ft. Wayne, Ind.

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The business wants of concerns and individuals are varied and always changing. Each day brings new wants; each day finds others filled.

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of this paper advertises the business wants of the organizations and men in this field. As their wants change, so do the "Searchlight" ads

For Every Business Want
Think "SEARCHLIGHT" First

G-20

POSITIONS WANTED

ELECTRICAL engineer, technical graduate, 14 years' experience in transmission, distribution and power plant operation, design and construction; available shortly. At present employed in construction of large outdoor substation. PW-444, Electrical World, 7 So. Dearborn St., Chicago, Ill.

ELECTRICAL engineer, technical graduate, 10 years' experience, construction, operating, appraisal, and valuation of public utility properties; also familiar with industrial installations. Available on short notice. PW-496, Electrical World, Real Estate Trust Bldg., Philadelphia, Pa.

ELECTRICAL engineer, age 27, over three years' general electrical testing experience, desires position in maintenance or power department of manufacturing concern. PW-505, Electrical World, Tenth Ave. at 36th St., New York.

FOURTH year night student of electrical engineering desires position in New York City where he will come in contact with electrical engineering work. PW-504, Electrical World, Tenth Ave. at 36th St., New York.

MECHANICAL and electrical engineer, 25 years' experience (international) transmission lines, sub-stations, power house and city distribution systems; power and appliance sales; business end of utility very strong; best of references; available at once. PW-491, Electrical World, Tenth Ave. at 36th St., New York.

METER engineer, American; 32 years; familiar with all makes of integrating, indicating and recording electrical instruments, demand devices, relays, etc., over five years supervisory experience in large meter departments, desires position with growing utility company. Moderate salary accepted where there is chance of advancement. PW-503, Electrical World, Leader-News Bldg., Cleveland, Ohio.

METER engineer, available to take charge of large meter department within thirty days. Professional record on request. PW-509, Elec. World, Tenth Ave. at 36th St., New York.

METERMAN wants position with electric company that offers an opportunity anywhere, but prefers West. Six months' experience. PW-457, Electrical World, 7 So. Dearborn St., Chicago, Ill.

POWER plant superintendent, 38; thirteen years' experience operating and maintenance central stations, industrial and public utility, technically trained in combustion, steam and electrical engineering. High-class operating executive. A-1 references. PW-494, Electrical World, Real Estate Trust Bldg., Philadelphia, Pa.

SHIFT engineer wishes to change to a plant where there is wider opportunity for advancement. At present employed in a modern 60,000-kw. steam plant; 1918. Two years college education, six years in this plant; 26 years old, married, healthy. PW-506, Electrical World, Real Estate Trust Bldg., Philadelphia, Pa.

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New York manufacturer of Conduit and Cable Fittings, etc., wants first class salesman to sell to electrical jobbers in New York State. Give full details of past employment, age and salary, etc.

AS-508, Electrical World
Tenth Ave. at 36th St., New York City

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Manufacturer of A. C. Motors, D. C. Motors, and Exhaust Fans, desires to arrange with established concerns, jobbers and dealers, who sell these types of apparatus, to act as selling agents. There are also several openings for experienced salesmen in the company's regularly established offices. SW-477, Electrical World, Tenth Ave. at 36th St., New York.

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Permanent and profitable connection for competent representatives. The use of Groundulets and other Groundit fittings is spreading rapidly. Fulfill 1925 Code requirements. Exceptional opportunity. Groundulet Company, 86 Park Place, Newark, N. J.

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U. S. Government

TREASURY DEPARTMENT, Supervising Architect's Office, Washington, D. C., June 16, 1925. Sealed proposals will be opened in this office at 3 p.m., July 6, 1925, for furnishing and installing lighting fixtures, wiring, etc., in the U. S. Marine Hospital, Portland, Me. Drawings and specifications may be obtained from the Officer in Charge at the Hospital or from this office in the discretion of the Supervising Architect. Jas. A. Wetmore, Acting Supervising Architect.

TREASURY DEPARTMENT, Supervising Architect's Office, Washington, D. C., June 18, 1925. Sealed proposals will be opened in this office at 3 p.m., July 14, 1925, for furnishing and installing a storage battery, etc., at the U. S. Quarantine Station, New Orleans, La., (Quarantine, La.). Specifications may be obtained from the Officer in Charge at the Station, or from this office in the discretion of the Supervising Architect. Jas. A. Wetmore, Acting Supervising Architect.

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Located in the heart of New York City, with shop, and full staff of salesmen and mechanics would like exclusive representation covering two or three machinery or electrical products. Address,

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Broadcast Motor Generator

1—Crocker-Wheeler Motor Generator Outfit. Motor 235 v. D.C., 1000 r.p.m., 5 hp. Generator supplying 1200 v. D.C., 2.5 amp., 1000 r.p.m., 1½ kw.
1—Crocker-Wheeler Motor Generator Outfit. Motor 235 v. D.C., 1100 r.p.m., 3 hp. Generator supplying 30 v. D.C., 50 amp., 1100 r.p.m., 1½ kw.
Both of the above complete, with switchboard for controlling. Suitable for a 1½ kw. broadcasting station designed therefor. Cost $2875; will sell for $1000. Further information upon request.

P. J. Larsen,
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70 Van Cortlandt Park South, New York City

Locomotive Crane

Bay City Industrial Electric Locomotive Crane, 50 hp., A.C. 220 or 440 v., 50-ft. boom, yard bucket, capacity 25,000 lb. at 12 ft., 9000 lb. at 25 ft., 5600 lb. at 40-ft. radius. Good condition. Price cheap.

Address—Paper Mill
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225 kva. Westinghouse Alternator. Direct connected to Semi Diesel Engine. Practically new. Displaced by large water power plant.

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Repairs and rewinds Motors, Generators, Regulators, Transformers and Turbine Fields.

Also makes and re-insulates coils for all kinds of Power Equipment.

WANTED

WANTED

Vertical Direct Connected Generator

About 150 kva., 2300 v., 60 cy., 150-250 r.p.m. Communicate with

MASON & PARKER MFG. CO.
Winchendon, Mass.

GREGORY ELECTRIC CO.

USED ELECTRICAL MACHINERY

Sixteenth and Lincoln Streets
Chicago, Illinois.

We have available one of the largest stocks of new and used electric generators and motors to be found anywhere—all used equipment is "Gregory Rebuilt" and operates like new, but sold at a big saving—this is only a partial list of our stock—send for our monthly bargain sheet, showing complete list with prices.

Three-Phase, 60 Cycle, A. C. Motors
220 or 440 Volts

Qu.	H.P.		Speed
1	7½	G.E., type MT-300Y, slip-ring	810
1	7½	Fairbanks-M., type B	720
1	7½	G. E., form K	720
1	7½	Westghse., type CS, high torque—intermittent duty	720
5	7½	Westghse., type CS	575
9	10	G.E., type KT	1800
3	10	Crawford	1800
1	10	G.E., type MT, slip-ring	1800
1	10	Westghse, type CCL	1700
1	10	G.E., type KT	1200
1	10	Crawford	1200
1	10	Allis-Ch., type ANY, sl.-rg.	1160
1	10	G.E., type KT	900
1	10	G.E., form M, slip-ring	900
10	10	G.E., form K	720
1	11	G.E., type ITC, form M, slip-ring	900
1	15	G.E., type KT	3600
1	15	Crawford, 220 v	1800
1	15	Lincoln, type HXG, 440 v., slip-ring	1800
10	15	Wagner, type BP	1750
1	15	Allis-Ch., type AN	1750
1	15	Fairbanks-M., type B	1200
2	15	Crawford, 220 v	1200
3	15	G.E., type KT	1200
6	15	G.E., type KT-326	1200
1	15	Allis-Ch., type AN	1150
2	15	Westghse., type CS	1150
3	15	Westghse., type CCL	1120

Three-Phase, 60 Cycle, A. C. Motors—Cont.
220 or 440 Volts

Qu.	H.P.		Speed
1	15	Westghse., type CS	860
2	15	Allis-Ch., type AN	850
3	15	G.E., type KT-332, totally enclosed	720
1	15	G.E., type I, form M, sl.-rg.	720
1	15	Westghse., type CS	675
1	20	Westghse., type CS	3450
2	20	G.E., type KT	1800
2	20	G.E., form M, 440 v., sl.-rg.	1800
9	20	Wagner, type BP	1750
19	20	G.E., type KT	1200

Three-Phase, 60 Cycle Motors
220 or 440 Volts

7	20	G.E., form K	900
2	20	Westghse., type CS	860
1	20	Crocker-Wh., 220 v	850
3	20	G.E., form K	720
1	20	Westghse., type CS	685
1	20	G.E., form K	600
1	22½	Lincoln	900
1	25	Fairbanks-M., type B	1800
1	25	Allis-Ch., type AN	1800
2	25	G.E., type KT	1200
1	25	Westghse., type CCL	1135
2	25	Wagner, type BP	900
8	25	G. E., type KT	900
2	25	Crocker-Wh.	850
1	25	Westghse., type CX	840
1	25	G.E., form K	720

Three-Phase, 60 Cycle Motors—Cont.
220 or 440 Volts

Qu.	H.P.		Speed
1	25	Westghse., type CS	690
1	25	Westghse., type CW, 440 v., slip-ring	680
3	25	Westghse., type CX	580
2	30	Westghse., type CS	1755
3	30	G.E., type KT, 220 v	1200
1	30	Allis-Ch., type AN	1160
1	40	Westghse., type CW, sli.-rg.	1160
1	40	Westghse., type CS	695
1	40	Westghse., MW., sl.-rg.	850
5	40	Westghse., CX	580
1	50	Fair.-M., type BV, sl.-rg.	1200
1	50	Allis-Ch., type AN	1160
1	50	G.E., type I, form M, sl.-rg.	900
1	50	Westghse., type CS	870
1	50	Westghse., CCL	680
1	50	G. E., form K	600
1	60	G.E., form KT	900
1	75	G.E., form K, 220 v	1800
1	75	G. E., form K, 2300 v	1800
2	75	G.E., type I, form M, sl.-rg.	860
1	75	Fair-M., type BV, sl.-rg.	690
1	75	G.E., form K	600
1	75	Westghse., type CW, sli.-rg.	435
1	100	Westghse., type CS	870
1	100	Allis-Ch., sl-rg., 2200 v	865
2	100	Westghse., type CW, sl.-rg.	350
1	250	Westghse., type C	850
1	250	Fair-M., type HV, sl.-rg.	600
2	250	G.E., type I, form M, sl.-rg.	385
1	300	G.E., type I, form M, sl.-rg.	1200

Three-Phase, 25 Cycle Motors
220 or 440 Volts

Qu.	H.P.		Speed
1	10	G.E., form M, sl.-rg.	750
1	10	Westghse., type HF, sl.-rg.	715
3	10	G.E., type I, form M, sl.-rg.	750
4	10	Wagner, type BP, new	750
1	15	Watson, type KH	720
1	20	Fairbanks-M., type B	750
2	20	Wagner, type BM	710
4	20	G.E., form K	750
1	25	G.E., form K	750
1	30	Fairbanks-M	750
1	30	Allis-Ch., AN	720
2	35	G.E., type I, form K	750
1	35	G.E., type I, form M, sl.-rg.	750
1	37	G.E., MTC, hoist motors	750
1	40	G.E., form K	1500
1	40	G.E., form K	750
1	40	Allis-Ch., AN	750
1	50	G.E., form K	1500
2	50	Allis-Ch., type AN	750
1	50	Fairbanks-M., type B	750
1	50	G.E., type I, form M, sl.-rg.	750
1	60	Allis-Ch., type AN	720
2	60	G.E., form K	720
1	75	Westghse., CI, hoist, motors	500
1	100	Westghse., CW, sl.-rg.	750
1	100	G.E., type I, form M, sl.-rg.	750
1	100	Wagner, type BR, sl-rg.	710
1	112	G.E., ITC., form M, sl.-rg.	710
1	125	G.E., form K	500
1	150	G.E., type I, form M, sl.-rg.	750
1	150	Allis-Ch., type ANY, sl.-rg.	750
1	200	Burke, 440 v	500

Telephones: Palisade 2600-2601

A. C. MOTORS—3 PHASE, 60 CYCL E

No.	Hp.	Rpm.	Volts	Type
1	500	360	220/440	West. HF., sl.rg
1	400	450	2200	G. E., synch.
1	250	720	2200	G. E., synch.
1	200	720	2200/440	Cr. Wh., sl. rg.
1	200	900	2200	G. E., sl.rg.
14	200	514	2300/440	G.E. synch.
2	200	514	2300/440	Westg., synchs.
1	200	900	2300	G. E., ATI, syn.
1	180	400	440/2300	Burke, sl.gr.3brg.
1	150	900	220/440	Allis-Chal. syn.
1	150	900	2300	G. E., syn.
1	100	720	220/440	Westghse. sl. rg.
1	100	257	2300	G. E., syn.
1	100	900	220/440	Ideal, sq. cg.
1	100	680	220	Cr. Wh., sq. cg.
1	100	720	2300	G. E., sq. cg.
1	75	490	440	Allis-Chal. S.R.
1	75	600	220	Westghse., CW
2	60	1800	220/440	G. E., Synchr.
1	60	1200	220	G. E., sl. rg.
2	50	900	220/440	West., CCL.
1	50	900	220/440	Westghse., sl.rg.
1	40	1700	220/440	Westghse., sl.rg.
1	40	720	220/440	West., sq. cg.
1	40	900	2200	Cr. Wheeler
1	35	1200	220	Cr.-Wh., syn.
1	35	720	220	G. E., sq. cg.
1	35	1800	220/440	G. E., syn.
2	35	1800	220/440	G. E., Syn
1	25	1200	2200	G. E., S.R.
1	25	1200	220/440	Allis-Chal.
1	25	720	220/440	G. E., K
1	25	900	220/440	G. E., K
1	20	900	220/440	G. E., sq. cg.
3	20	1200	220/440	G. E., sq. cg.
3	15	1200	220/440	G. E., K
3	15	1800	220/440	G. E., KT
3	10	1200	220/440	G. E., KTI
1	10	900	220	Westg. HF
2	7½	900	220/440	G. E., MT
1	5	1800	220/440	Westg.
4	5	1200	220/440	G. E., KT
2	2	1800	220/440	G. E.

(2 Phase Motors on request)

D. C. GENERATORS—250 VOLT

No.	Kw.	Rpm.	Type
1	250	825	G.E., DMC
1	75	450	Diehl
1	50	600	Westghse.
1	30	1000	Westghse.

(Smaller sizes on request)

D. C. GENERATORS—125 VOLT
5, 10, 20, 22, 35, 50, 75 kw.

D. C. MOTORS—230 VOLT

No.	Hp.	Rpm.	Type
1	120	725	West, S
1	90	470	G. E., CL
1	75	850	Diehl
1	50	700	Cr. Wheeler, CM
1	50	275/550	Diehl
1	50	200	Diehl
1	50	650	Sprague
1	40	400	Diehl
1	40	1300	Diehl
1	35	200	Diehl
1	35	700	Cr. Wheeler
1	35	420	Diehl
1	30	500	Diehl
1	25	600	Sprague
1	25	500/1500	Allis Chalmers
1	20	665	Diehl
1	20	200	Diehl
1	20	900	Diehl
1	15	1050	Cr. Wheeler, CM
1	15	925	G. E., CVC
16	10	1350	Rochester
1	7½	1150	Sprague, C
1	5	1200	G. E., RC
1	3	1200	G. E., CVC

(Smaller sizes on request.)

D. C. MOTORS—125 VOLT

1	75	850	West. SK
2	50	275/550	Diehl interpole
1	20	650	G. E.
1	15	775	SK, Westg.
1	5	700	Diehl
1	5	3 5	G. E. vert.
3	3	1100	G. E.
2	3	1700	G. E.

D. C. MOTORS—500 VOLT

1	50	250/1000	G. E., RLC, new.

A. C. GENERATORS

No.	Kw.	Rpm.	Volts	Ph.	Type
1	1000	900	2300	3	G. E. Syn. Con.
1	300	450	2300	3	G. E., P.
1	200	720	2200	3	G. E. P.
2	100	900	2300	3	G. E., P.
1	75	1200	220/440	3	Cr.-Wheeler
2	35	180	220/440	3	G. E.

TURBINE

1—400 kw., 3600 rev., 3 ph., 60 cy., 2300 v. Allis-Chalmers Barometric Condenser.

ENGINE GENERATOR SETS

1—200 kw., 250 v., D.C. Gen., connected to Allis Chal., 18x36 right hand Corliss Engine.

1—150 kw., 200 rev., 125/250 v., 3 wire G. E engine type (generator only).

1—100 kw., 125 v., 2 wire, D.C. Westinghouse R.H. gen., conn. to Harrisburg std. tand. cud., 11x18x13 engine, 275 r.p.m., complete.

1—75 kva. General Electric, 257 r.p.m., 3 ph 60 cy., 440/2300 v., dir. conn. engine generator sets

1—40 kw., 250 v., D.C., West.-Lycoming-simple, 325 r.p.m., complete.

MOTOR GENERATOR SETS

300 kw., 250/500 v., 3 ph., 60 cy., 2300 v. Westinghouse syn. motor generator set.

250 kw., 250 v. Al. Ch. Gen., 375 hp., 450 rev. 2300 v. G. E. Syn. Motor.

200 kw, 250 v. G. E. Generator, with 300 hp. 2300/440 v. G. E., form K motor, 720 r.p.m —150 kw., 250 v., D. C., 2300/4400 A. C. West. syn. motor generator set.

1—100 kw., 250 v., D. C. 2300/440 A.C. G.E. syn. motor generator set.

100 kw., 250 v. Gen., 900 r.p.m., 2200 synchronous motor.

50 kw., 720 rev., 250 v. Gen., 75 hp., 220/440 v. motor.

10-20-25-40 kw., 125 v. Exciter Sets.

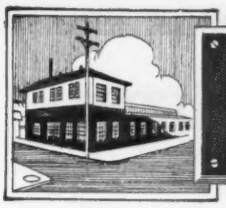
TRANSFORMERS

1—5000 kva., 3 ph., O.I.S.C.—outdoor—44000 v. Delta, H. T., 22000/11000 V. L. T.

4—150 kva., type H, 50 cy., 8000/2300 v. G. E., form KDD, brand new.

1—25-kw. G. E. type H. oil cooled 440-220/110-v. brand new.

3—75-kw. Maloney transformers, R.E., single phase 60 cy., oil cooled indoor—2200/220-110 v.



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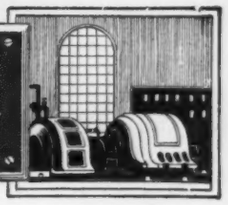

TELEPHONES: New York Direct Wire: Rector 3891; HOBOKEN 3750

New and Used Electrical Equipment—Condition Guaranteed—Ready to Ship

Slip Ring Motors—3-Phase, 60-Cycle

Hp.	Volts	Speed	Make	Type
400	440/220	514	General Electric	M
250	2200	600	General Electric	M
200	2200	600	General Electric	M
200	220 440	600	General Electric	M
150	2200	600	General Electric	M
150	2200	720	General Electric	M
150	550	600	General Electric	M
150	220/440	600	General Electric	M
100	440/220	600	General Electric	M
100	2200	720	General Electric	M
100	440/220	720	General Electric	M
100	550	720	General Electric	M
75	550	720	General Electric	M
75	2200	720	General Electric	M
75	220/440	720	General Electric	M
75	220/440	900	General Electric	M
75	220/440	514	General Electric	M
75	550	900	General Electric	M
60	550	900	General Electric	M
55	220/440	514	General Electric	M
50	550	900	General Electric	M
50	440/220	900	General Electric	M
50	2200	900	General Electric	M
35	40/220	900	General Electric	M
35	2200	900	General Electric	M
35	550	900	General Electric	M

DIRECT CURRENT MOTORS

200	230	800	General Electric	RC
175	115	575	Crocker-Wheeler	Interpole
75	115	400	Crocker-Wheeler	D
50	115	750	Westinghouse	SK
50	220	525	Westinghouse	S
50	220	950	Westinghouse	S
40	220	700	Westinghouse	S
40	230	1150	Westinghouse	SK
35	230	700	Crocker-Wheeler	I
30	110	575	Westinghouse	S
25	115	875	Sprague	D
25	230	750	Crocker-Wheeler	I
20	230	900	Westinghouse	SK
20	230	800	General Electric	RC
15	230	1250	Allis-Chalmers	Interpole

Synchronous Motors, 3-ph., 60-cy.

300	2200	450	Elec. Mchy. 3 bgs.	
242	2200	514	General Electric:	ATI
100	2200	900	Westinghouse	G

Squirrel Cage—3-phase, 60-Cycle Motors

125	440/220	900	General Electric	K
100	440/220	900	General Electric	K
100	440/220	720	General Electric	K
75	440/220	720	General Electric	K
75	550	514	General Electric	K
50	440/220	1200	General Electric	K
50	440/220	900	General Electric	K
40	440/220	900	General Electric	KT
40	440/220	600	General Electric	K
35	440/220	720	General Electric	K
35	550	900	General Electric	K
35	220/440	900	General Electric	K
30	220/440	900	General Electric	KT
25	220/440	900	Westinghouse	CS
25	440/220	900	General Electric	KT
25	220/440	720	General Electric	K
20	220/440	900	General Electric	K
15	220/440	1200	General Electric	KT
10	220/440	1200	General Electric	K

DIRECT CURRENT GENERATORS

Kw	Volts	Speed	Make	Type
200	125	650	Crocker-Wheeler	Interpole
175	250	950	General Electric	RC
125	250	580	Sprague	....
75	250	850	General Electric	D
70	125	475	Crocker-Wheeler	D
62½	125	280	Sprague	....
60	125	925	Sprague	D
50	125	850	Westinghouse	SK
45	125	975	General Electric	CLB
40	250	850	Westinghouse	S
40	250	1100	Crocker-Wheeler	I
35	125	775	Sprague	D
12	250	600	Westinghouse	SK

MOTOR GENERATOR SETS

1—175-kw., 125-volt, 600-r.p.m. Crocker-Wheeler Interpole Generator, coupled to 240-hp., 2200-440-volt, 3-ph., 60-cy. General Electric synchronous motor.

1—175-kw., 250-v., 900-r.p.m., Gen. Elec. Type RC Generator connected to 240-hp., 2200-volt, 3-ph., 60-cy., Gen. Elec. Type ATI synchronous motor.

ALTERNATING CURRENT GENERATORS

1—312-kw., Westinghouse, 2300-v., 514-r.p.m., 3-ph., 60-cy., 3 Bearing type with belted exciter.

1—200 kw. Gen. Elec. 2300-v., 600-r.p.m., 3-ph., 60 cy. Type ATB with belted exciter.

1—192-kw., 514-r.p.m., 2300-v., 3-ph., 60-cy. Gen. Elec. Type ATB, with belted exciter.

1—75-kva. General Electric, 480/240 volt, 1200 r.p.m., 3-ph., 60-cy. Type ATB with direct connected exciter.

1—75-kw., 900-r.p.m., 2300-v., 3-ph., 60-cy. Westinghouse Type G, with belted exciter.

TURBO-GENERATORS

3—500-kw., Westinghouse, 2300/550/440-volt, 3600-r.p.m., 3-ph., 60-cy. turbo-generators, with barometric condensers.

ENGINE GENERATOR SETS

2—400-kw. 125/250-v., 3-wire General Electric 115-r.p.m. D.C. Generators connected to 24x42 Hamilton Corliss left hand engines.

2—200-kw., 250-v., 150-r.p.m. General Electric type MPC. Interpole D.C. Generators connected to 21x24 Ames Uniflow Engines suitable for 150-lb. pressure and 150-deg. superheat.

1—60-kva., 240/480-volt, 300-r.p.m., General Electric Type TRB, A.C. Generator connected to 11x12 Skinner Engine (will reconnect for 2-ph).

1—30-kw., 250-volt, 300-r.p.m. Gen. Elec., D. C. Generator, dir. conn. to 10x10 Ames Engine.

If your requirements are not listed, write us, as we do not attempt to list our entire stock.

TURBINES

1—1000 kw., .80 P.F., type ATB-2-1250-3600, form T, 3600 r.p.m., 3 ph., 60 cy., 2300 v., General Electric Generator direct connected to 1000 kw. Curtis turbine.

1—1000 kw., .80 P.F., 2300 v., 3 ph., 60 cy., Ridgway Generator direct connected to a Ridgway Rateau-Smoot turbine complete with C. H. Wheeler Mfg. Co. condenser.

1—1000 kw., 2 ph., 60 cy., 2400 v., 3600 r.p.m. (can be reconnected 3 ph.) General Electric to 1000 kw. General Electric-Curtis turbine with Alberger Barometric condenser.

1—750 kw., 2 ph., 60 cy., 2400 v., 1800 r.p.m., General Electric Generator to a 750 kw., General Electric horizontal turbine with Alberger Barometric condenser.

1—600 KW., BRAND NEW, 3 PH., 60 CY., 480 V. OR 2300 V., GENERAL ELECTRIC-CURTIS TURBO GENERATOR UNIT.

2—500 kw., .80 P.F., type ATB, 3 ph., 60 cy., 2300 v., General Electric Generator direct connected to a 500 kw., Curtis turbine with LeBlanc motor driven condenser.

POWER EQUIPMENT OUR SPECIALTY

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TRANSFORMERS

We have over 1500 Transformers in stock totalling more than 50,000 Kva. Sizes 1 to 500 Kva. Save 30 to 50% on your Transformer purchases.

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Our rewinding prices and guarantee will interest you!

Always in the market to buy late type Transformers, either in good condition or burned out.

Any size—any quantity. **Do you receive our monthly stock bulletin?**

Power Machinery Exchange

1 Montgomery Street, Jersey City, N.J.

A. C. Units

3-Phase, 60-Cycle

Kva.	Gen.	Engine	Price
470	Wghse.	Parsons Tur. Non. Conn.	$4500
330	Al.-Chal.	Al.-Chal. Corliss	5250
312	G. E.	Skinner Unaflow	6500
250	Al.-Chal.	Al.- Chal. Corliss	3750
225	G. E.	Monarch Corliss	3000
185	G. E.	Skinner	2250
150	Al.-Chal.	Al.-Chal. Corliss	3000
125	G. E.	Chuse	1750
105	G. E.	Ide Ideal	1500
105	Wghse.	Ridgway	1500
75	Al.-Chal.	Chandler Taylor	1250
75	Wghse.	Chuse 4 V.	1250

SPECIALS

625 kva. Gen. Elec. Curtis Turbo Gen. Unit, 3 ph., 60 cy. with condenser and switchboard.

500 kva. Cr. Wheeler 3 ph., 60 cy., 440-220 v., with Hewes Phillips Cr. Comp. Corliss Engine.

470 kva. Westinghouse Parsons Turbo Generator, 3 ph., 60 cy., with condenser and switchboard, $5500.

375 kva. G. E. 3 ph., 60 cy. Gen., dir. con. Erie Ball 4 valve Engine, $5500.

360 kva. Gen. Elec. 3 ph., 60 cy., with Harris Cr. Comp. Corliss Engine with condenser.

BOILERS

8—600 Edgemoor W.T., 200 lb.
2—308 Heine W.T., 175 lb. ASME.
2—295 B. & W. Stirling ASME, 160 lb., $2500 each.
3—200 hp. H.R.T., 150 lb., with stacks, $1150 each.
2—150 hp. H.R.T., 150 lb., with stacks, $2750.

All Boilers furnished with insurance company's certificate.

Boilers, Engines, Motors and Generators. All sizes. Write for information.

2000 Hp. Boiler Plant Complete

WITH STEEL BUILDING-BUNKERS-STACKS-STOKERS AND ACCESSORIES

4—512 hp. Sterling Boilers, Class S-26, 200 lb., A.S.M.E. Std. Used 2 years, built 1917—EXCELLENT!
4—72-in. x 141-ft. Steel Stacks, guyed. 4—B. & W. Chain Grate Stokers, engine driven.

Also Feed Water Heater, Pumps, Steam Header and all fittings. Boiler House, Steel construction, 107 ft. long x 33 ft. wide, with cupola.

Steel Bunkers built integral with building, equipped with steam hoist, mounted on building for pulling railroad cars up incline on top of bunkers, for dumping directly into them.

Railroad tracks both sides of building. Will sell As Is or load on cars—to suit buyer.

A. LEE ELLIS

10 High Street **TELEPHONE CONGRESS 4597** **Boston, Mass.**

TRANSFORMER BARGAINS

SINGLE PHASE — 60 CYCLE

No.	Kva.	Make	Voltage	Price Each
1	10	Adams Bagnall	230/115	$40.00
2	15	Westinghouse	11000-575	50.00
3	25	Westinghouse	11000-575	75.00
10	30	Westinghouse	11000-575	90.00
1	31	Pittsburgh	4650-2200	100.00
1	35	Pittsburgh	4650-2200	110.00
4	37½	Westinghouse	11000-575	115.00
3	100	New Moloney	6600-440/220	250.00
1	100	Westinghouse	2100-232/116	200.00
1	100	Westinghouse	2100-464/232	200.00
6	200	New Moloney	6600-440/220	375.00
2	200	Westinghouse	2080-460/230	370.00
		3 PHASE — 60 CYCLE		
1	100	Westinghouse	2080/1980-460/230	250.00
1	100	Westinghouse	2200Y-244/488	250.00
1	100	Westinghouse	2100/2000-464/232	250.00
		SINGLE PHASE — 25 CYCLE		
3	125	Westinghouse	11000-400	200.00
3	125	Westinghouse	11000-400	200.00

THE NATIONAL POWER MACHINERY COMPANY
1913 Scranton Road, Cleveland, Ohio

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FOR EXCHANGE ?

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Clearing House for

MOTORS AND DYNAMOS

We *buy, sell, rent or exchange* any kind of

ELECTRICAL EQUIPMENT

Motors and Generator Sets built to specifications

L. J. LAND, 207 Centre St., New York City

GOOD USABLE EQUIPMENT PRICED TO MOVE AT ONCE

All this equipment was replaced by reason of changing to 60 cycle A.C. in formerly D.C. and 25 cycle Districts

MOTORS

3-Phase, 25-Cycle Motors, Squirrel Cage, Standard Makes

9—15 hp.	6—50 hp.	7—150 hp.
5—35 hp.	5—75 hp.	1—350 hp.
10—40 hp.	1—100 hp.	1—375 hp.
	1—450 hp.	

Slip Ring

3—10 hp.	1—20 hp.	1—300 hp.
4—15 hp.	1—22 hp.	1—450 hp.
	1—750 hp.	

SWITCHES

Knife
37—Standard makes 20 to 16,000 amps., 110 to 500 volt.

Oil
114—Without switchboard, relays or operating handles. Standard makes, 100 to 600 amps., 2500 to 16,500 volts.

Remote Control
6—G. E. 15,000 volt, 300 amps., with motor.

FREQUENCY CHANGERS

3— 500 KVA., General Electric. Generator, 2400 volt, 62½ cycle. Motor, 6600 volt, 25 cycle.
1250 KVA., Westinghouse. Generator, 2400 volt, 62½ cycle. Motor, 6600 volt, 25 cycle.

ROTARY CONVERTERS

1—750 KW. G.E., 275 volt-135 volt, direct current side, 25 cycle on a.c. side.
1—1500 KW. G. E., 225 volt-275 volt, direct current side, 25 cycle on a.c. side.
1—1500 KW. G. E., 275 volt, direct current side, 25 cycle on a.c. side.
1—2000 KW., G.E., 225 volt-300 volt, direct current side, 25 cycle on a.c. side.
All above with equipment necessary for operation.

TRANSFORMERS

Distribution
Twenty-five cycle (will operate on 60 cy.), single and three phase, 2300-6600 volt primary, 110-220, 220-440 volt, 1 to 375 kw.

Constant Current
5—Westinghouse, 25 cy., 8 to 48 kva., 6300 to 6600 volt, 4 to 6.6 amp.
9—Westinghouse and G.E., 60 cy., 68 to 70 kva., 2200 to 2540 volt, 6.6. amps.

Instrument
8—G. E., 1500 to 15,000 volt, 5 to 10 amps.

INSTRUMENT TRANSFORMERS

98—2500 volt, 30 amps. and up to 600 amps.
39—7500 volt, 10 amps. and up to 1500 amps.
100—15,000 volt, 30 amps. and up to 600 amps.
2—440/110 volt, 50 watts.
34—2200/110 volt, 200 watts.
14—4400/110 volt, 200 watts.
30—6600/110 volt, 200 watts.
3—13,000-110 volt, 200 watts.

This Is Not a Complete List of Available Equipment. **NOTE: As we are constantly changing over more A.C. districts it will pay you to let us know your needs. Address all inquiries to W. C. Blair, Industrial Engineer.**

KANSAS CITY POWER & LIGHT CO., Grand Ave. at 14th St., Kansas City, Mo.

HONESTLY REBUILT

SYNCHRONOUS MOTORS

GUARANTEED

1—150 hp., 3 ph., 60 cy., 480 v. Gen'l Elect. type ATI, form C, 900 r.p.m. Synchronous Motor with belted exciter and starting panel.

1—200 hp., 3 ph., 60 cy., 2200 v. Gen'l Elect. type ATI, form B, 600 r.p.m. Synchronous Motor with exciter and starting panel.

1—435 hp., 3 ph., 60 cy., 2200 v Gen'l Elect. type ATI, form B, 450 r.p.m. Synchronous Motor with exciter and compensator.

GUARANTEED

REBUILT-IN-OUR-SHOPS

Operating Condition Equal to New
Fully Guaranteed

Miller-Owen Electric Co., Inc.
Pittsburgh, Penna.

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(3)

ELECTRICAL MACHINERY

ROTARY CONVERTERS

1—500 kw. **Westinghouse Rotary Converter,** 60 cy., 6 ph., 430 v. A.C., 600 v. D.C., 833 amp., 900 r.p.m., equipped with speed limit device, bridged pole pieces, field rheostat and starting switch. Also 1—525 kva. Westinghouse Oil Insulated, self-cooled 3-ph. Transformer, 2300 v. primary, 430 v. secondary for 6 ph. operation. Rotary will be sold with or without transformer as may be required.

1—500 kw. **General Electric Rotary Converter,** Type HC, Form P, 60 cy., 6 ph., 430 v. A.C., 600 v., 833 amp. D.C., 600 r.p.m., with end play and speed limit devices, also starting switch; also 3—165 kva. General Electric, oil insulated, self-cooled Transformers, 13,200/6600 v. with 4 primary taps; 430/186/143 v. secy. A.C. panel board with instruments. Rotary will be sold with or without transformers as may be required.

MOTOR GENERATOR SET

1—300 kw. **Allis-Chalmers, Self-Contained Motor Generator Set,** 40 deg. type. Generator—Allis-Chalmers, compound wound, 500 amps., 550-600 v., 600 r.p.m.; Motor—Allis-Chalmers synchronous motor, 3 ph., 60 cy., 2300 v., 87 amp., 2 bearing, with direct connected exciter, D.C. starting panel and field rheostat. We can furnish transformers for operating the motor from high voltage line.

Archer & Baldwin, Inc., Bound Brook, N. J.
Telephone—760-761-762 Bound Brook

PRICED TO SELL

ROTARY CONVERTERS

2—300-kw. Allis-Chalmers Synchronous Converters, DC, 250 volts—AC 6 phase, 60 cycle, 1200 r.p.m. Fully complete including Transformers and Switchboards.

MOTOR GENERATOR SETS

1—150 kw. Gen. Elec. Set—Generator DMC, comp'd interpole, 250 volt, 600 amps.—Motor ATI Synchronous, 220 volt, 3 ph., 60 cy., 900 r.p.m.
1—100 kw. Electric Machy. Set—Generator comp'd interpole, 250 volt, 400 amp.—Motor Synchr. self starting, 440-220 volt, 60 cy., 900 r.p.m.
1—100 kw. Gen. Elec. Set—Generator CL-B, comp'd 250 volt, 400 amp.—Motor I, form K, 220—3—60—600 r.p.m.
1—65 kw. Gen. Electric—Generator CL-A, 250 volt, comp'd—Motor 100 hp. Crocker-Wheeler, 220 volt, 2 ph., 60 cy., 575 r.p.m.

BELYEA COMPANY, INC. — MOTORS GENERATORS — ELECTRICAL EQUIPMENT

MOTORS—GENERATORS—ENGINE SETS AND OTHER ELECTRICAL EQUIPMENT

Belyea Co., Inc., 145-151 W. 18th St. New York City

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PRICED TO SELL

1—100 hp. Wagner BP, 3 ph., 60 cy., 2200 v., 850 r.p.m., with rails, pulley and compensator $600

1—50 hp. Lincoln, 3 ph., 60 cy., 220/440 v., 1800 r.p.m., with compensator $240

18—10 hp. General Electric type KT **Motors,** 3 ph., 60 cy., 220 v., 690 r.p.m., with bases, pulleys and compensators .....$185 ea.

1—3 hp. Allis-Chalmers, 3 ph., 60 cy., 220 v., 565 r.p.m.....$70

5—½ hp. Fidelity **Slip Ring Motors,** 3 ph., 60 cy., 220 v., 1200 r.p.m. with hand operated regulators...$50 ea.

10—¼ hp. General Elec., 3 ph., 60 cy., 110 v., 1800 r.p.m.....$10 ea.

Slip Ring Motors from ¼ to 400 hp.

Squirrel Cage Motors, ¼ to 200 hp.

Direct Current Motors, all sizes and Voltages.

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Philadelphia

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TURBO UNITS

5000 kw., Allis-Chalmers, 3-60-2200
2500 kw., Westinghouse, 2-3-60-2200
1500 kw., Gen. Electric, 3-60-2200
1000 kw., Gen. Electric, 2-3-60-2200
750 kw., Gen. Electric, 2-3-60-2200
500 kw., Gen. Electric, 3-60-600
250 kw., Allis Terry, 3-60-2400
100 kw., Gen. Electric, 3-60-600
250 kw., Diehl-Kerr, 125 v. D.C.

ENGINE SETS

600 kw., G. E. Hewes & Phillips, 3-60-2200
187 kw., G. E. Fitchburg, 3-60-600
40 kw., G. E. Ames, 125 v. D. C.

CONVERTERS

500 kw., G. E., 3-60-13200/6600-240 v. 300 v.
300 kw., G. E., 3-60-2300/4000-250 v.

M. G. SETS

500 kw., G. E. Generator, 250 v., 900 r.p.m. d.c. to syn. motor 3-60-2300 Panels
200 kw., Allis-Chalmers, Generator 250-275 v., d.c. to syn. motor 3-60-2300 Panels.
100 kw., Westinghouse, 250 v. Generator, d. c. to syn. motor 2-60-2200 Panels

BOILERS

4—512-hp., Class S-26 Stirling 200 lbs. steam pressure A.S.M.E. std., 8 yrs. old, operated 2 yrs. Excellent condition. Equipment-chain grate stokers, feed water heater, feed water pumps, four steel stacks, steam headers, regular fittings, steel bunkers and steel building 107 ft. long x 33 ft. wide.

TRANSFORMERS

4—667 kva., Moloney, 1-60-13800 6900-460 v.
1—500 kva., G. E., 3-60-11000 22000-4000 v.
3—500 kva., G. E., 1-60-2540-15200/11800-2300 v.
6—333 kva., Pitts., 1-60-13800/6900-2200v.
1—10 kva., Pitts., 3-60-2200/220-110 v.

COMPRESSORS

500 kw., G. E., 3-60-13200/6600-240 v. to
2350 ft. Worthington, 3-60-550.
1730 ft. Chicago OCE, 3-60 any voltage
1302 ft. Ingersoll PRE-2, 2-3-60-2300.
714 ft. Ingersoll (Clearance Control) 3-60-440-220
528 ft. Ingersoll ER-1, Belt
173 ft. Ingersoll ER1, Belt
1955 ft. Ingersoll XPV-3, Steam
1723 ft. Ingersoll XPV-3, Steam
1190 ft. Ingersoll X-3, Steam
528 ft. Ingersoll FR-1, Steam
396 ft. Sullivan WB-2, Steam

See Engineering News-Record and Power for other equipment.

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1—75 kva. DeLaval, 125 lb. steam pressure, gear connected to 2—37.5 kva., 220-volt DeLaval generators. Incl. cable, valves, etc.

Condenser

for 400 hp. B & S cross compound engine, complete with 12x16x18x18-x18-in. pumps.

$575.00 for both

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ALSO

3125-2500 and 1875 Kva.

All 60 cy., 3 ph., 2300-4400 v., with condensers and auxiliaries. Can also furnish Boilers, etc.

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A recent purchase of steel tanks gives us a large stock of Pflauder Seamless Ring, Bolted, Sectional Tanks, sizes from 100 gallons up. Also 20 Pflauder Enameled Oval Pans, 12-ft.x36-in.x18-in. with flanged connections. (These were never used), and 20 Graver Corporation riveted steel storage tanks, vertical and horizontal.

Nashville Industrial Corporation
Old Hickory, Tennessee

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Oil Circuit Breakers

42—G. E. Solenoid Operated. Type F, Form K 12, 300 Amp., 15,000 v. with B-10 relays and solenoid.

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3500 kw., 2300 v., 3 ph., 60 cy., with condenser and accessories. Immediate delivery. Can be operated under load for inspector.

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New 100 hp., G. E., 3 ph 300 r.p.m.
Type I, Form K

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1—Stickle 400 B.H.P. No. 4 Open Coil Feed Water Heater and Purifier complete.
1—American 400 B.H.P. No. 18 Feed Water Heater, complete.
3—Warren Webster Open Type Feed Water Heaters, 11,000 B.H.P. capacity each.

Nashville Industrial Corporation
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Find Your Needs Here!

MOTORS

1—400 hp. 440 v. 514 r.p.m. 3 bear. var. spd.
1—135 hp. 2200 v. 1200 r.p.m. Cr. Wh.
1—100 hp. 2200 v. 600 r.p.m. Var. Spd.
1—100 hp. 440 v. 720 r.p.m. G. E.

TRANSFORMERS

3—200 kva. 4000/440/220 v.
3—125 kva. 4000/440/220 v.
3—100 kva. 2100/464/232 v.
3— 75 kva. 2200/1100/460/230 v.

GENERATOR

1—125 kva. 225 v. 3 ph. 277 r.p.m. dir. con. to McIntosh Seymour full Diesel engine. Complete. NEW. All in good condition and guaranteed.

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(4)

FOR SALE

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1—500 Kw. Allis-Chalmers Steam Turbo Generator, 600 volt, 3 phase, 60 cycle.
1—500 Kw. Westinghouse-Parsons Steam Turbo Generator, 2-ph., 220-v., with condenser and auxiliaries.
1—300 Kw. General Electric, 3-ph., 60-cy., 2300-v., 450 r.p.m. Belted Generator.

CORLISS ENGINES, ETC.

1—14x16 Harrisburg Corliss Engine, direct connected to 160 Kw. Western Electric direct current generator, 115-125-v.
1—21x30, 400-hp., Erie City left hand, heavy duty, automatic, 4-valve Corliss engine.

BOILERS

2—200-hp., 2—150 hp., and 1—100-hp. High Pressure Horizontal Return Tubular Boilers.

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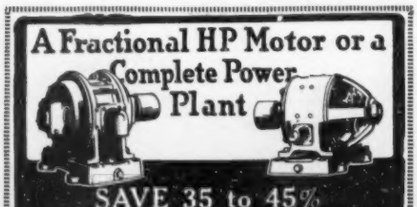

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6—16-in. Allis-Chalmers Type S with 300 h.p. Turbine.

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Old Hickory, Tennessee

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Nashville Industrial Corporation
Old Hickory, Tennessee

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12—823-hp. Babcock & Wilcox Stirling Water Tube Boilers, Class M-30, 200 lbs. pressure. Complete with Westinghouse stokers, forced draft fans, Vulcan soot blowers and all accessories. Slightly used and a bargain.

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3—Westinghouse Outdoor Type, 100 kva., 2400-240-120 v., 60 cy., 2 ph., Type S.

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15—West. Type P, 600 Amp., 15,000 V., S. P. S. T.
24—Gen. Dev. and Ftgs., 600 Amp., 15,000 V., Disconnecting Switches, S. P. D. T.

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1—Buffalo, 45,000 cu. ft., A. P. M. at 6-in. Water Pressure

Arc Lamps

150—G. E. 4 Ampere Magnetite

Lightning Arresters

350—G. E. 4,000 V. with and without Boxes.

Available Immediately.

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1000 KVA. ENGINE SET

440 v., 60 cy., 3 ph. G. E.
Engine 24x48x48—100 Rev.

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Practically New

6—400-hp. Wickes Vertical Water Tube Boilers, 175 lbs. pressure, complete with Murphy stokers, Crane non-return valves, 48-in.x90-ft. steel stacks and all accessories.
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Nashville Industrial Corporation
Old Hickory, Tennessee

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Motors **Rotaries**
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1560 kva. Westinghouse 440-3-60 direct conn. Low Pressure Steam Turbine.
187 kva. Westinghouse 440-3-60 direct conn. High Pressure Steam Turbine.
15 kw. Van Winkle A.C.
50 kw. Westinghouse A.C. 1300 r.p.m.
60 kw. Triumph D.C. 850 r.p.m.
150 kw. Milwaukee D.C.
150 kw. Westinghouse D.C., direct conn. to Erie Steam Engine.
220 kw. Crocker Wheeler D.C. direct conn. to Erie Automatic Steam Engine.
200 kw. General Electric D.C., direct conn. to Erie Steam Engine.

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50 hp. Penn. R. T. Port. 100 lb.
66-in.x16-ft. R. T. 100 lbs.
72-in.x18-ft. R. T.
72-in.x18-ft. Erie City R. T. 125 lbs.
72-in.x18-ft. Kewaunee Heating Boilers.
250 hp. Standard Water Tube 200 lbs.

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50 hp. Erie Auto. Cent. Crank.
100 hp. Buckeye Left Hand.
120 hp. Ideal Auto. Right Hand.
130 hp. Russell Left Hand Side Crank.
175 hp. hp. Atlas Left Hand Side Crank.
220 hp. Allis Right Hand Corliss.
238 hp. Ridgway Cent. Crank.
278 hp. Ohio Right Hand Corliss.
286 hp. Cooper Right Hand Corliss.
500 hp. Erie City Left Hand.

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5-ton Whiting Crane 220 volt D.C. 35-ft. span.
10-ton Morgan Crane 220 volt D.C. 65-ft. span.
30-ton Morgan Crane 220 volt D.C. 73-ft. span.
30-ton Morgan Crane 220 volt D.C. 70-ft. span.

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440-220 volt 3 phase 60 cycle.
5—75 hp. Squirrel and Slip Ring Motors.
100 hp. G.E. 700 r.p.m.
200 hp. G.E. 600 r.p.m. Slip Ring.
250 hp. Westinghouse Squirrel Cage 514 r.p.m.

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28-in. Round Magnet 220 volt D. C.
7x20-ft. Mine Ventilating Fan.
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No. 8658-E Leeds & Northrup Indicators.
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The Wire that Made Electric Heat Possible

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Highest Heat Resistance
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Dielectric Strength

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Bare and Tinned Copper Wire, Enameled, Cotton, Silk, Cotton Enameled and Silk Enameled Magnet Wire.

Coil Windings for Ignition, Radio, Meter, Telephone, Transformers, X-Ray, Violet-Ray, Magnets and every electrical purpose.

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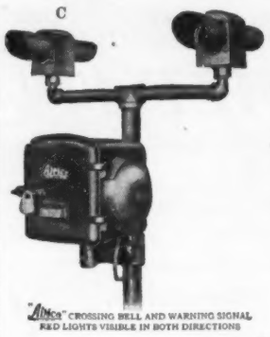

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INTERIOR OF CASE SHOWING OPERATING MECHANISM

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cuts time in TWO

With two tapes in one, only one wrapping is necessary and the labor saved, is extra profit to you.

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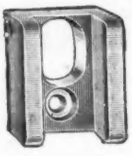

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Transmission Lines

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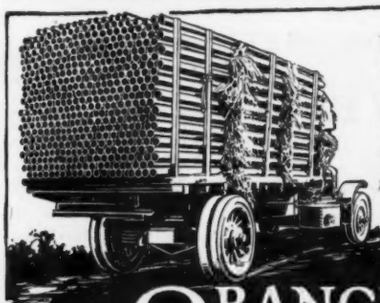

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This guarantees you a perfect Process of Pole Butt Preservation.

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Largest Manufacturers of Transformers exclusively in the United States

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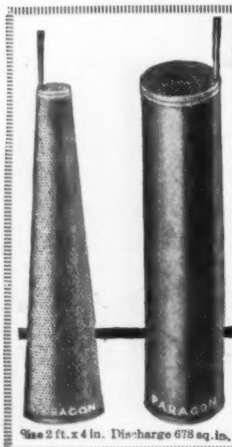

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Furnish adequate, dependable, durable grounding. Protect dependably valuable electric equipment from lightning, high tension crossed and other excess potential.

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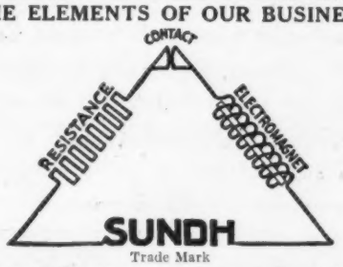

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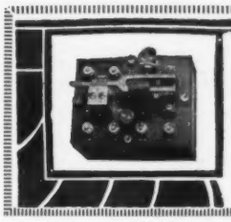

Radio and Laboratory Instruments
Bulletin L

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A Much Needed Instrument

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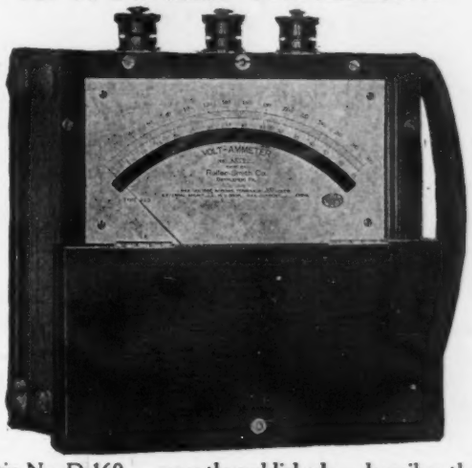
Type GSA

A. C. Portable Volt-Ammeter



Bulletin No. D-160 — recently published — describes the new ROLLER-SMITH Type GSA Volt-Ammeter and also type GSA Ammeters, Voltmeters, Single and Polyphase Wattmeters, Frequency Meters, Power Factor Meters, Transformers, Multipliers, and "Y" Boxes, which represent a complete testing outfit for any shop or station.

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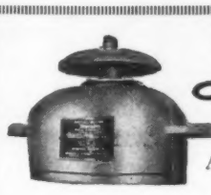

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All Dielectrics All Purposes

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are built with resistances as high as 30,000 ohms—.1 amp., and as low as .34 ohm—25 amps. 57 different ratings.

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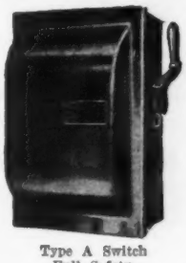

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Built for hard usage and designed especially for use in industrial plants. The most complete line on the market in all amperes, voltages and types.

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Railroad Ties, Bridge Timbers, Piles, Poles, Paving Blocks and Lumber — Manufacturers of Cross Arms and Wyckoff Conduit for Underground Wires.

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A Type for Every Service

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Cedar Poles are *personally* inspected and run true to specifications/

Your orders given prompt attention

BUTT TREATMENT *by guaranteed KANIKSU process*/

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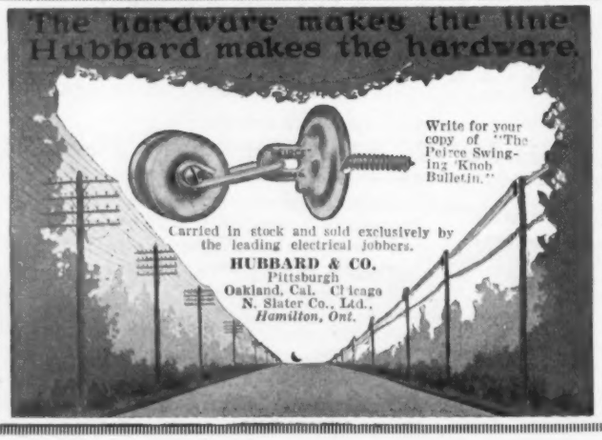
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in this space in all issues where larger display space is not used backs up your advertising campaign and keeps your name in the alphabetical index.

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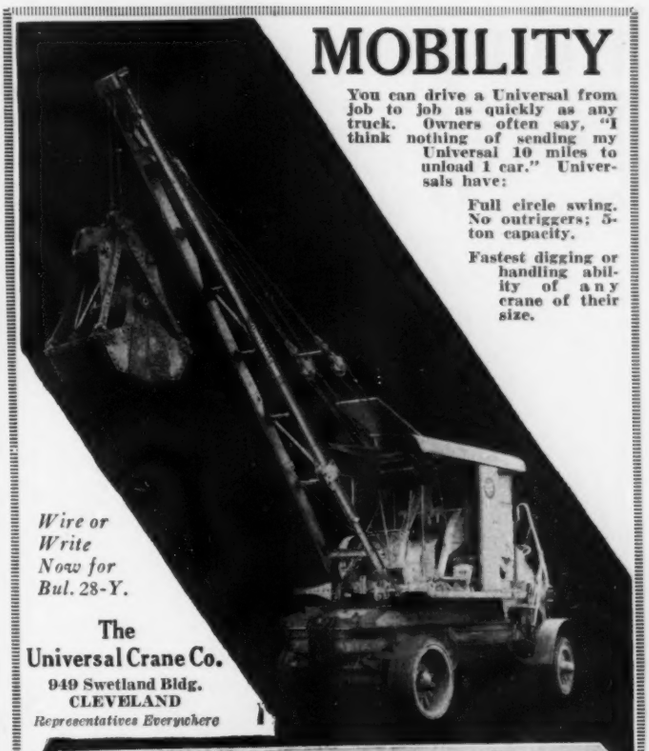

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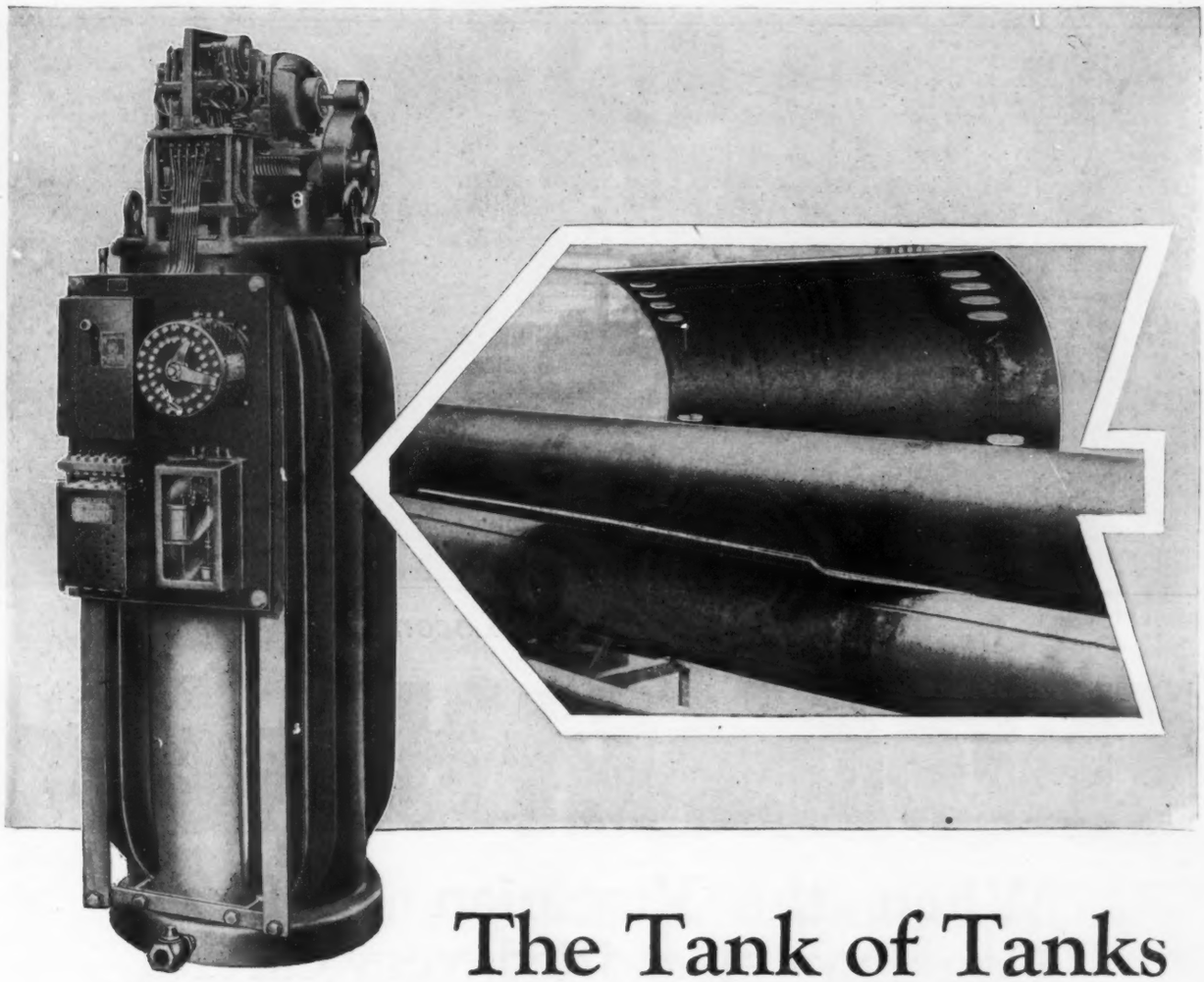

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23 to 115 Kv-a.

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A tank that is round in order to have the stresses uniformly distributed against the wall and thereby minimize the probability of bulging or rupture.

A tank of thick boiler plate that withstands most successfully the high internal pressures that result from abnormal operating conditions.

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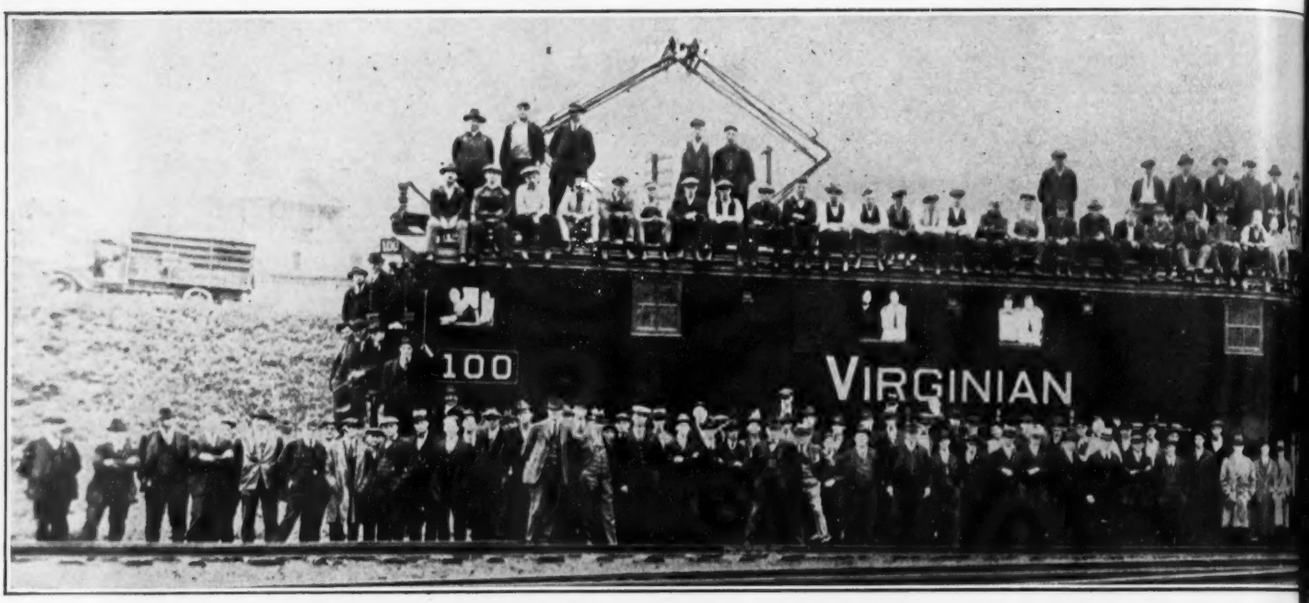

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This Giant depends

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The Lopulco Pulverized Fuel System was chosen.

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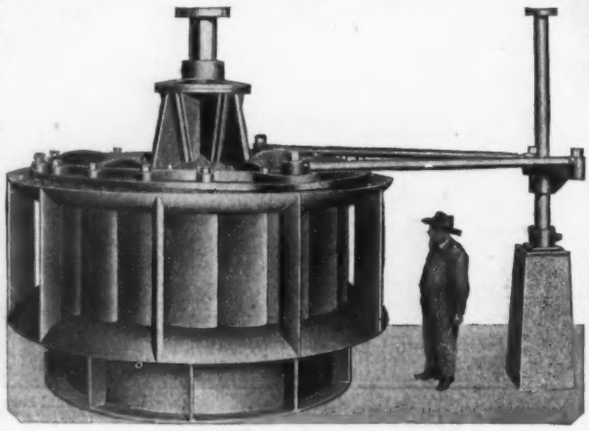
Throughout the World

LEFFEL

TURBINE WATER WHEELS

High Speeds, High Powers, High Efficiencies



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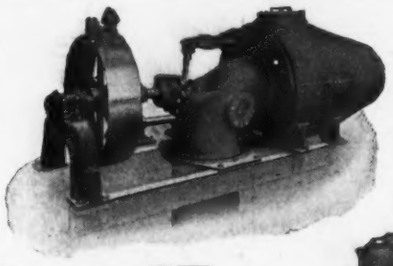

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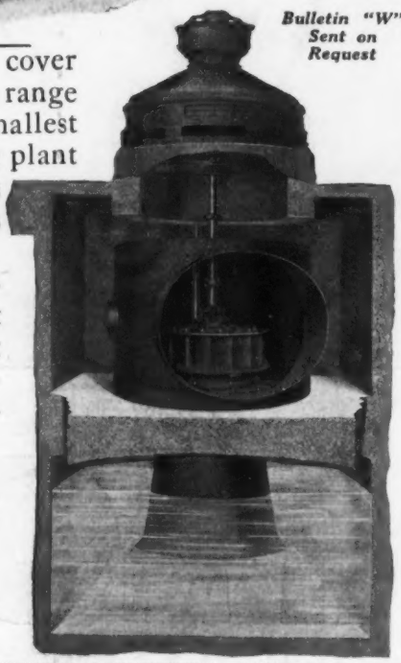

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reduce fuel costs by making use of waste exhaust gases to preheat the boiler feed. Patented construction proven by 20 years of service.

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improve engine, turbine and boiler economy by enabling a given amount of steam to do more work. Over 10,000 installations in stationary power plants.

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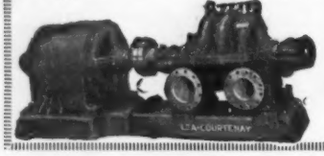

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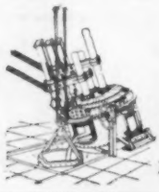

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Ten Standard Sizes ½ to 24 Tons Capacity
Most Rapid and efficient for making
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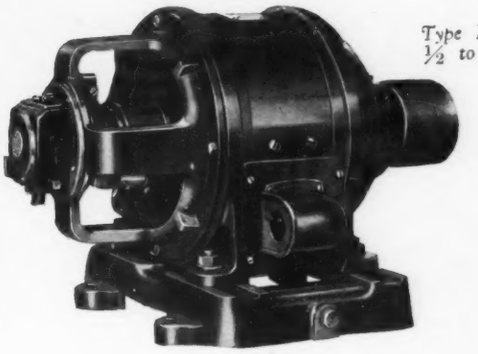
Announcing

TWO NEW DIRECT-CURRENT MOTORS



Type BD Motor—Sizes ½ to 3 h.p. inclusive.

Type CD Motor—Sizes 3 to 200 h.p. inclusive.

FOUR-SQUARE superiority in an electric motor demands a combination of certain indispensable factors: adequate research facilities—high grade designing ability—liberal manufacturing resources—extensive practical experience.

Combination of these factors in General Electric's new Type BD and Type CD Motors marks a distinctive kind of craftsmanship—*balanced excellence* in the design and manufacture of direct-current motors.

To obtain full value from your investments in direct-current motors, use the new Type BD or Type CD Motor.

Complete information is available at your nearest G-E office —or G-E Motor Dealer

8B-1

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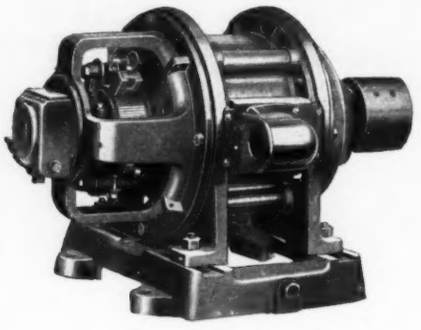
GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN ALL LARGE CITIES

IMPROVEMENT

IMPROVEMENT is the keynote in the design, manufacture, application and servicing of G-E Motors—improvement in mechanical strength, simplicity, and interchangeability—improvement in workmanship, material, and test—improvement in appearance and finish—improvement in stock, warehousing, repair and service facilities.

Thus, all G-E Motor purchasers are assured *balanced excellence* in the factors which make up complete user satisfaction.



Type SCR Single phase Motor —Sizes ½ to 10 h.p. inclusive.

Type KT Polyphase Motor— sizes ½ to 15 h.p. inclusive.

For general purpose uses paralleling the new Type BD and Type CD Motors, the Type KT (polyphase) and the Type SCR (single phase) alternating-current Motors are successfully operating in thousands of installations. Whatever the circuit requirements or demands of service—there is a G-E Motor to fit the need.

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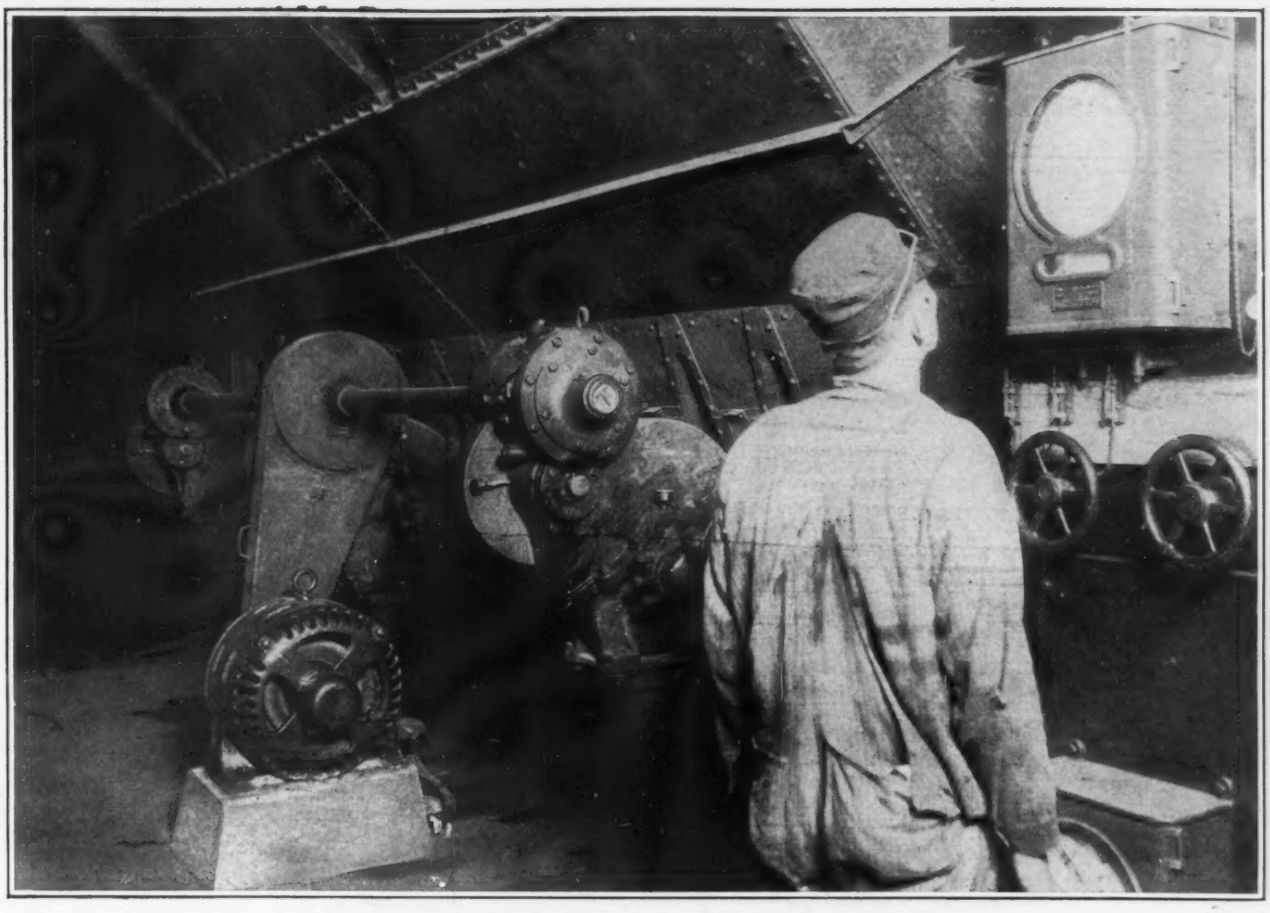

New Type TAYLOR STOKER under a 1190-horsepower boiler in the Spy Run Station of the Indiana Service Corporation, Fort Wayne, Ind.

"The Taylor a life-saver when our load jumped up"

The winter following the installation of the Taylor Stoker in the Spy Run Station of the Indiana Service Corporation, their fast-growing load jumped 20,000-kw. to a new high level. The Taylor-fired boiler bore the brunt of the heavy extra load—and handled the job with ease.

Is it any wonder the Superintendent of the Spy Run Station characterized the Taylor as a "life-saver"?

Yet this performance at Spy Run was not exceptional for the Taylor Stoker. It is doing this same thing every day in plants throughout the country.

With the Taylor Stoker in your boiler room you always have ample reserve for meeting load crises.

Write for the new Taylor Catalog

AMERICAN ENGINEERING COMPANY
PHILADELPHIA

Manufactured in Canada by TAYLOR STOKER CO., Ltd., Toronto, Ont.
Principal Canadian Sales Office—416 Phillips Place, Montreal, Que.

The Taylor Stoker

Gets more heat from a pound of coal than any other Combustion System

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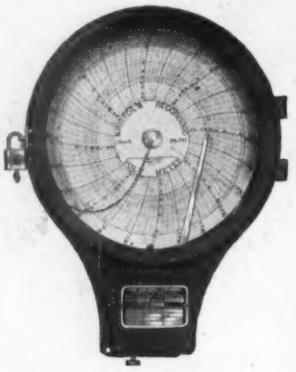
Continuous chart records furnished by Bristol's Recording Electrical Instruments installed at these important points give accurate and concise information regarding load distribution. Abnormal loads, voltage drop or fluctuation are clearly shown by the charts, making it possible to correct the trouble without delay and before annoying complaints are received from consumers.



Recording Voltmeter for Wall or Switchboard

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For full details just write for Bulletins 1007-*L*, 1203-*L*, 1401-*L*, 1501-*L and new Bulletin just issued*—332.

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The profitable operation of a hydro-electric plant is largely dependent on the governing of the turbine. The selection of Woodward Governors insures the best results from the start, prompt service and freedom from expensive delays.

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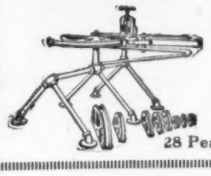

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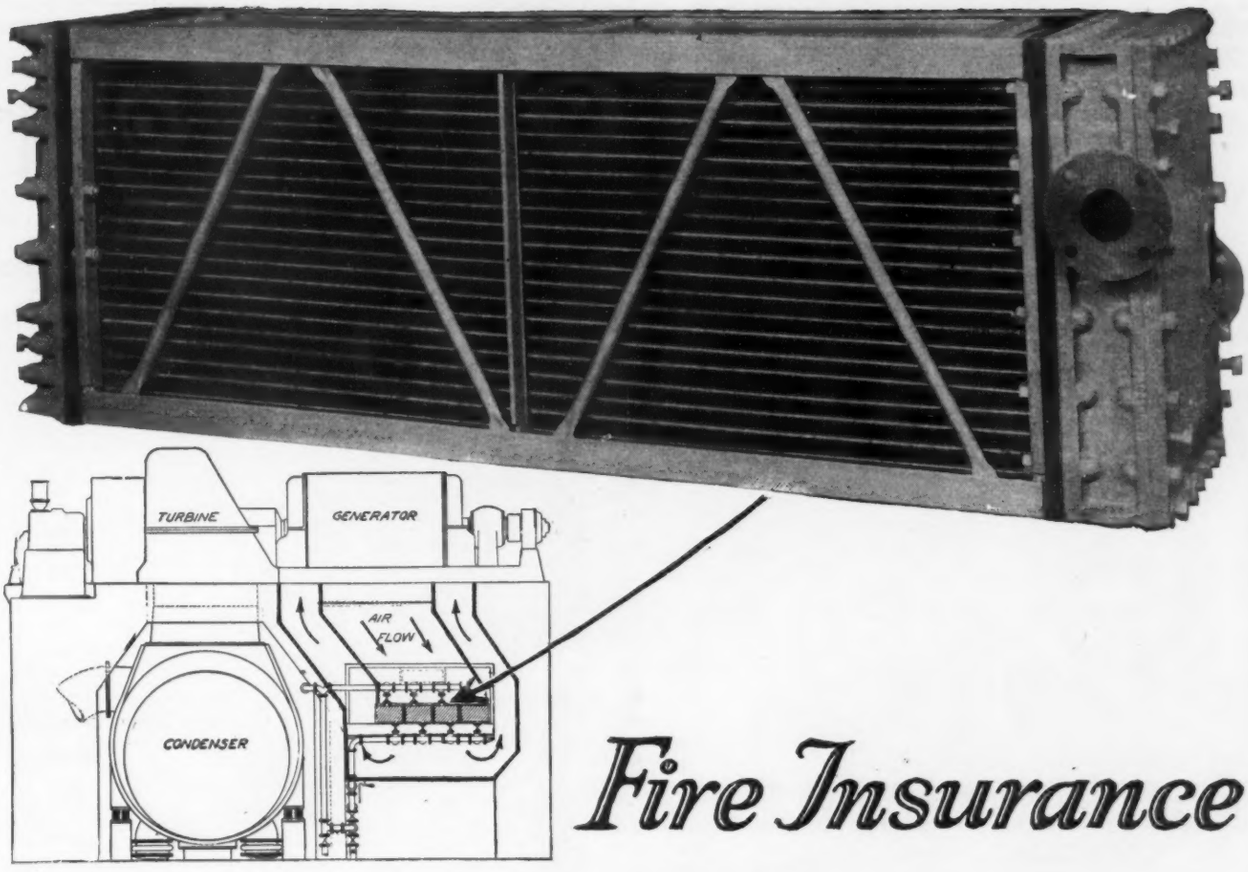

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Protect your generators with G-E Surface Air Coolers

Exclusive G-E Features

Helically wound and shouldered copper fin designed for maximum heat transfer.

Extremely simple multi-pass water box with removable cover plate.

Individual tubes easily removed and replaced.

Non-corrodible, muntz-metal tube sheets, one inch in thickness.

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Heavy, rigidly welded, structural steel frame.

Simple, but rigid, tube support at center of tube bank.

The G-E Surface Air Cooler operates in a closed system. The volume of air in such a system can support but a small amount of combustion. A fire started in the generator windings will be immediately smothered.

The generator is protected also against dirt and other harmful agents coming in contact with the insulation, because the closed system contains only clean, dry air and re-circulates it over and over.

Still other advantages of the closed system of ventilation are:

Generator losses heat feed water
Less noise from circulating air
Very simple air ducts

G-E Surface Air Coolers are easily installed for existing equipment. By all means include them in new installations.

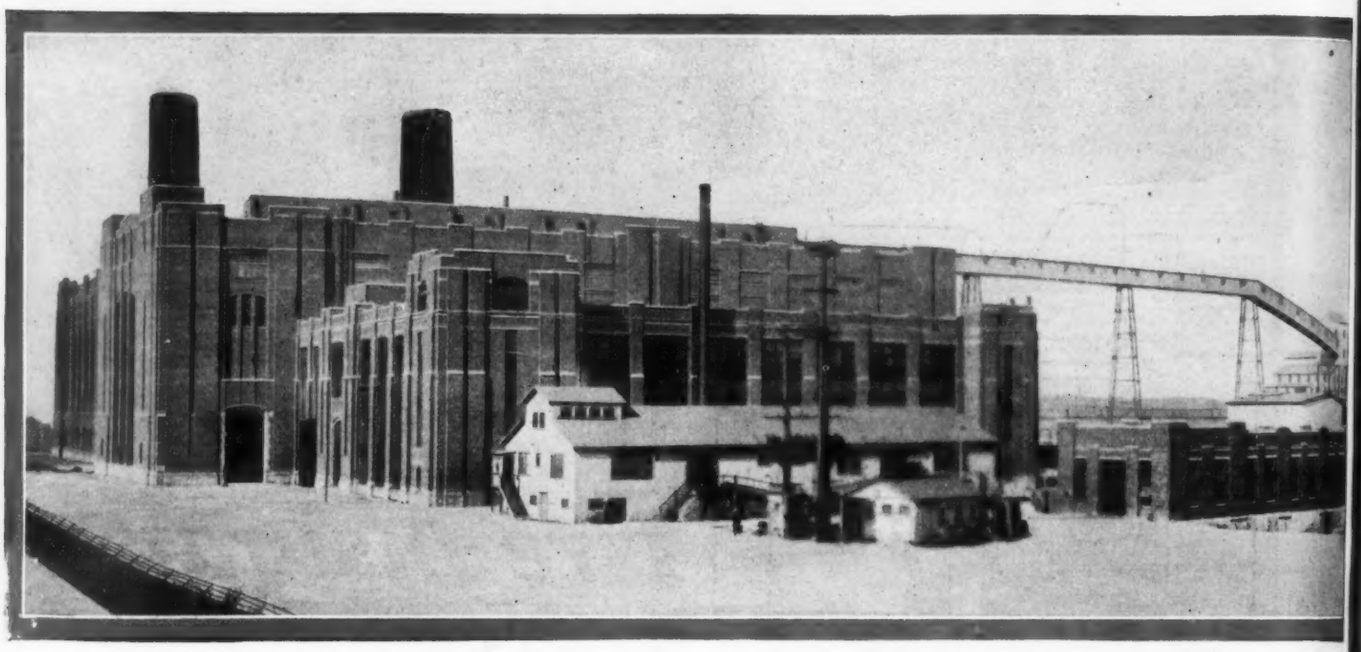
Bulletin 45609

55-7

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y. SALES OFFICES IN ALL LARGE CITIES

—at Crawford



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New Generating Station of the Commonwealth Edison Company, Chicago.
Present Capacity, 160,000 Kw.

IN THE Commonwealth Edison Company's newly opened Crawford Avenue Station, these Bethlehem units are installed:

—Three Bethlehem Turbine-driven Centrifugal Feed Pumps (Weir Type). Each of these pumps is capable of delivering 900 G.P.M. against a feed header pressure of 700 lbs. per square inch, the steam pressure being 600 lbs. Total temperature of steam 750°.

—A Complete Closed Circuit Automatic Feed Water System, consisting of:

2 Two-stage Vertical Spindle Electrically-operated Hotwell Pumps.

5 Bleeder Heaters, multiflow surface type.

2 Turbine-driven Booster Pumps.

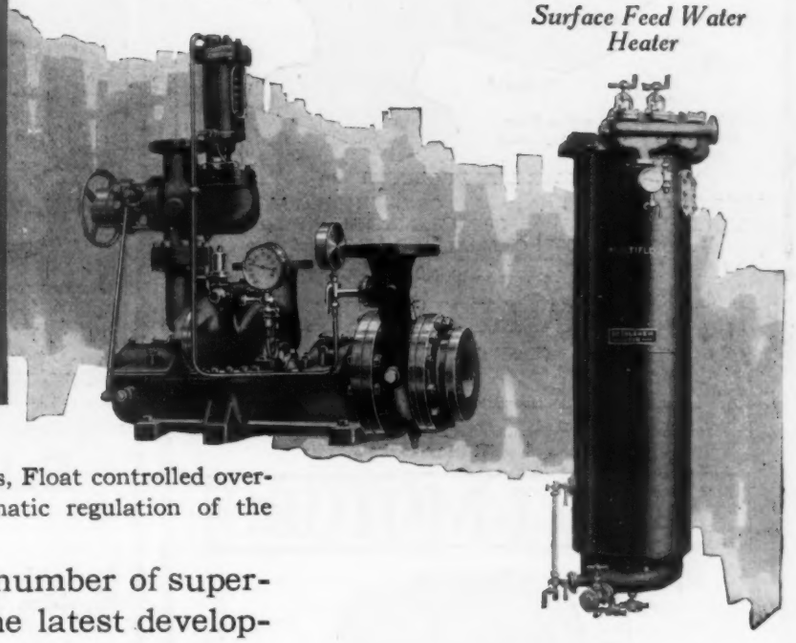
2 Electrically-operated 3560 R.P.M., 1000 Gallon, 700 lbs. discharge pressure, Multi-stage Boiler Feed Pumps.

BETHLEHEM

Avenue Station

Turbine-driven Centrifugal Feed Pump

Surface Feed Water Heater



6 Sets Steam Jet Air Extraction Apparatus, Float controlled overflow and make-up valves for the automatic regulation of the quantity of feed water in system.

Crawford Avenue is one of a number of super-power stations, embodying the latest developments in power plant practice, that use Bethlehem Equipment.

In plants of the giant, super-power type, and in smaller plants as well, the auxiliary services can be entrusted to Bethlehem Equipment with entire confidence.

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BETHLEHEM, PA.

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(Weir Type)

Consists of a single-stage centrifugal pump direct connected to a steam turbine. Pump and turbine are mounted on the same casing, forming a single, compact unit.

SURFACE FEED WATER HEATER
(Weir Type)

All units fitted with straight copper tubes of heavy gauge.

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A New Speed Reducer

WITH EXCLUSIVE ADVANTAGES

1st—Prime Mover and Reducer in actual operation before load is picked up. Results: No starting shocks and reduction in starting torque.

2nd—All vibration and back lash eliminated. Result: No noise.

Step up or reduce the speed.

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Furnished in ratios from 4:1 to 200:1 and any load up to 500 HP.

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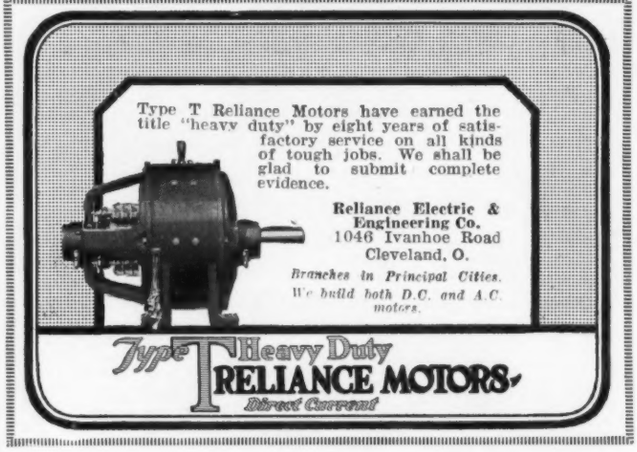
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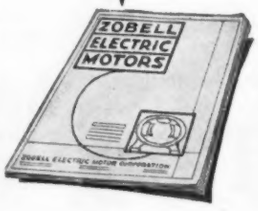

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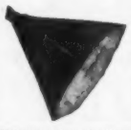

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For General Purpose
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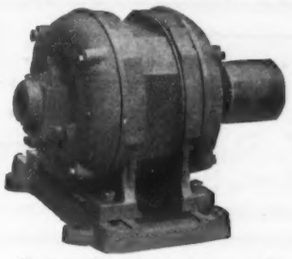

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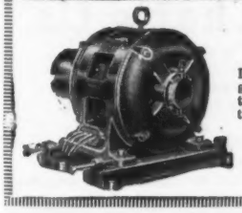

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Slip Ring
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Direct Current
The Triumph Electric Co., Cincinnati, O
Builders of Motors Since 1892

Bouth Hai

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It is there that wives get the big deal.

Inheritance goes through the female line and she takes her husband, and keeps him if he acts right.

If he doesn't, she gets rid of him by simply uttering *bouth hai,* which is the equivalent of Shakespeare's "Out naughty spot," and she takes unto herself a more fitting worker.

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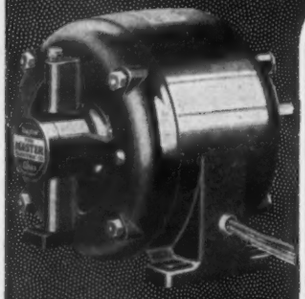

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⅛ to 7½ H.P.

Less than 40°

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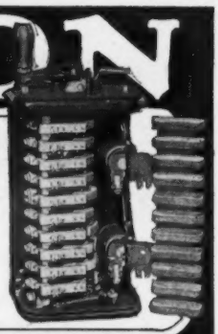

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Single and Polyphase
Generators and Generating Sets

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Ward Leonard Electric Company
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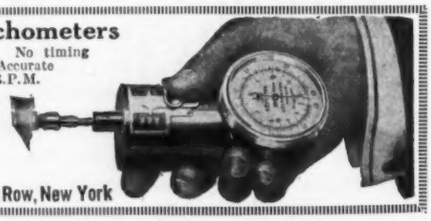

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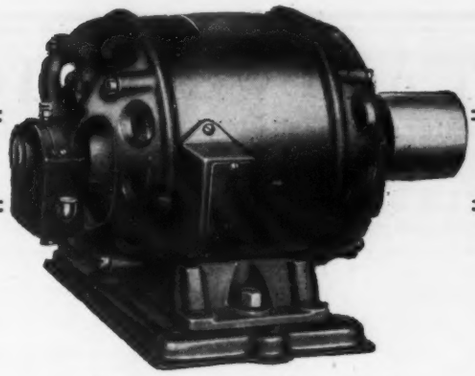

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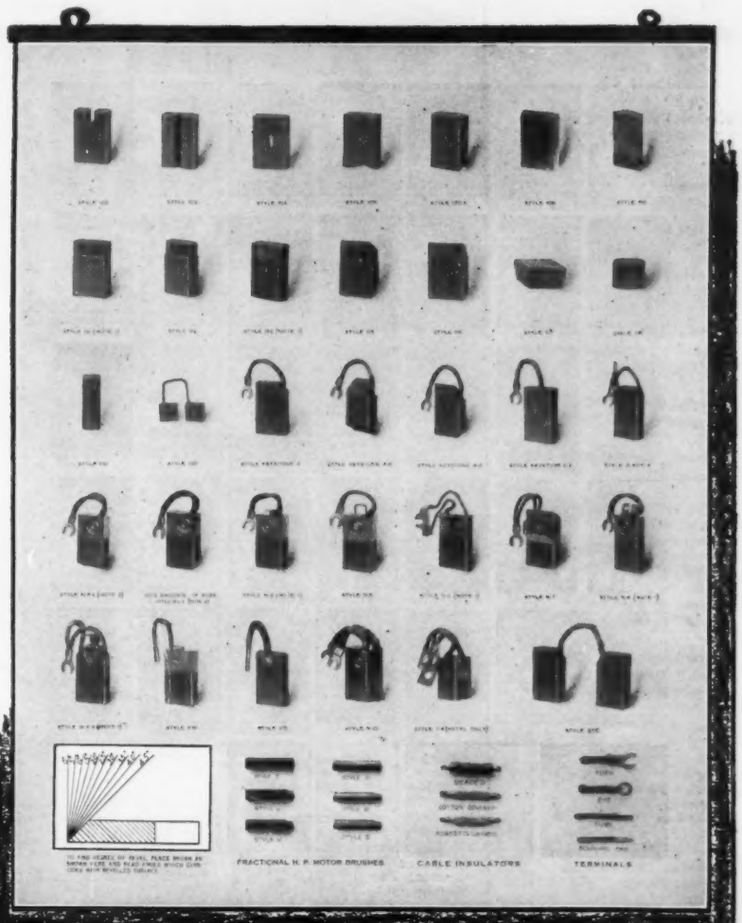

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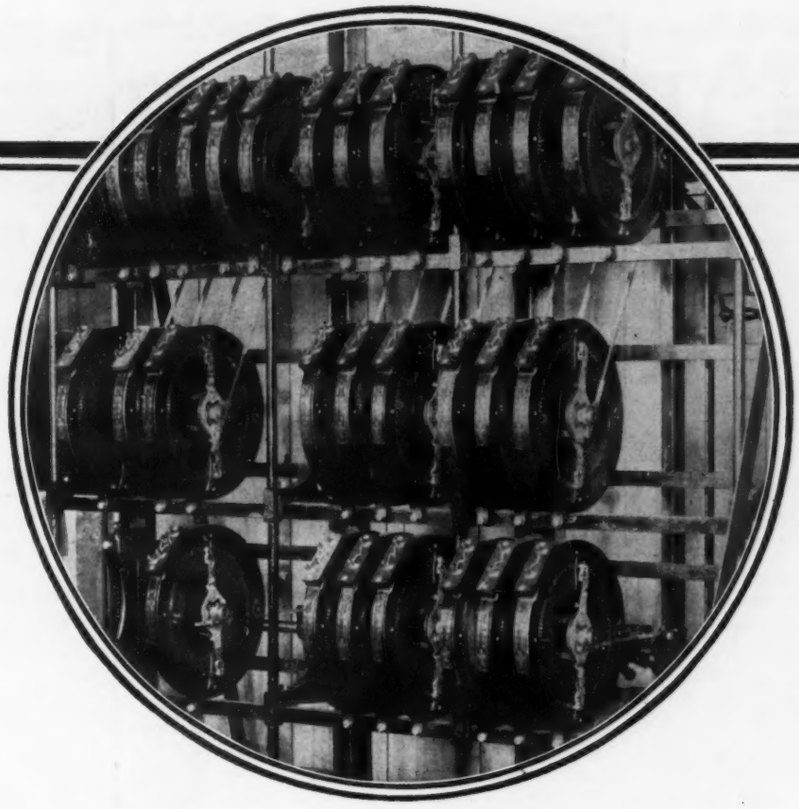
Simplicity

THEATRE DIMMERS



Eight Reasons Why C-H Dimmers Are Found in Majority of Theatres

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ALPHABETICAL INDEX TO ADVERTISEMENTS

Page

A

Aermotor Co. ... 42
Allis-Chalmers Mfg. Co. ... 67
Allis Co., Louis ... 59
Allison & Co., James E. ... 28
Aluminum Co. of America ... 39
Ambursen Constr. Co. ... 28
American Brass Co. ... 41
American Bridge Co. ... 45
American Engineering Co. ... 53
American Insulated Wire & Cable Co. ... 40
American Insulatg. Mchy. Co. ... 40
American Lava Corp. ... 40
American Pipe Bend. Mach. Co. 54
American Sheet & Tin Plate Co. 41
American Steel & Wire Co. ... 40
Anaconda Copper Mining Co. ... 41
Anderson Mfg. Co., A. & J. M. ... 43
Archbold-Brady Co. ... 44
Austin Co. ... 27
Archer & Baldwin, Inc. ... 35
Automatic Elec. Washer ... 21

B

Babcock & Wilcox Co. ... 54
Bakelite Corp. ... 39
Baker Platinum Works ... 38
Baldor Electric Co. ... 58
Bates Expanded Steel Truss Co. B. C.
Battey & Kip ... 28
Bell Lumber Co. ... 46
Belyea Co., Inc. ... 35
Bethlehem Shipbldg. Corp. ... 56, 57
Biddle, Jas. G. ... 43
Black & Veatch ... 28
Blake Signal & Mfg. Co. ... 38
Bristol Co. ... 54
Bureau of Commercial Economics, Inc. ... 28
Burke Electric Co. ... 59
Busch-Sulzer Bros. Diesel Eng. Co. ... 54
Business Research Corp. ... 28
Byllesby ... 28

C

Cameron Elec. Mfg. Co. ... 60
Cattie & Bros., Jos. P. ... 39
Century Electric Co. ... 61
Cheney, Edw. J. ... 28
Chicago Pump Co. ... 54
Combustion Engr. Corp. ... 46, 48, 49
Condensite Co. of America ... 39
Consolidated Gas & Elec. Co. ... 37
Consolidated Products Co. ... 34-36
Consumers Power Co. ... 16, 17
Continental Fibre Co. ... 39
Cook Porcelain Ins. Corp. ... 44
Cooper, Hugh L. ... 28
Copperweld Steel Co. ... 39
Corliss Carbon Co. ... 63
Cutler-Hammer Mfg. Co. ... 65

D

Dachner Elec. Equip. Co. ... 36
Daley & Co., M. J. ... 28
Day & Zimmermann, Inc. ... 28
De Laval Steam Turbine Co. ... 50
Delta-Star Electric Co. ... 6
Detroit Elec. Furnace Co. ... 50
Diehl Mfg. Co. ... 58
Directory of Engineers ... 28, 29
Doble Engr. Co. ... 42
Dudlo Mfg. Co. ... 38
Duncan Elec. Mfg. Co. ... 20

E

Electric Bond & Share Co. ... 46
Electric Power Equip. Corp. ... 45
Elec'l Repair & Equip. Co. ... 31
Electric Service Co., Inc. ... 33
Electric Service Supplies Co. ... 46
Electrical Development & Mach. Co. ... 44
Electrical Testing Laboratories. 28
Electrical World ... 3
Ellis, A. Lee ... 34, 36
Emerson Elec. Mfg. Co. ... 59
Engineers' Directory ... 28, 29

F

Fargo Eng'g Co ... 28
Fibre Conduit Co. ... 42
Ford, Bacon & Davis ... 28
Fort Wayne Correspondence School ... 30
Fowle & Co., Frank F. ... 28
Freeman, Samuel T. ... 29
Fuerst-Friedman Co. ... 36
Fynn, Val A. ... 28

G

G. & W. Elec. Spec. Co. ... 42
Gannett, Seelye & Fleming ... 28
Garfield Mfg. Co. ... 41
General Bakelite Co. ... 39
General Electric Co., 7, 10, 22, 24, 25, 47, 51, 52. 55
General Insulate Co. ... 40
General Porcelain Co. ... 42
General Radio Co. ... 43
Gregory Electric Co. ... 32

H

Hall & Co., Stephen ... 33
Hall Bros., Cedar Co. ... 45
Harper & Taylor ... 28
Harris Bros. Co. ... 37
Harza, L. F. ... 28
Hatch, Edwin G. ... 28
Hemphill & Co., Inc., J. L. ... 32
Hi-Voltage Equipment Co. ... 11
Holfast Rubber Co. ... 40
Hoosier Eng. Co. ... 28
Hoskins Mfg. Co. ... 38
Hubbard Co. ... 44

I

Imperial Porcelain Works ... 39
Indiana Rub. & Ins. Wire Co., 3rd Cover
Irvington Varnish & Ins. Co. ... 41
Ives & Davidson ... 28

J

Jeannin Electric Co. ... 58
Johns-Manville, Inc. ... 42
Johns-Pratt Co. ... 8, 9
Junod & Co., L. H. ... 43

K

Kaniksu Cedar Co. ... 44
Kansas City Power & Light Co. 34
Kerite Ins. Wire Co. ... 26
Kirchberger & Co., Inc., M. ... 38
Klein & Sons, Mathias ... 44
Krehbiel Co. ... 28
Kuhlman Electric Co. ... 44

Page

L

Land, L. J. ... 34
Landis & Gyr, Ltd. ... 43
Lapp Insulator Co., Inc. ... 44
Larner Engrg. Co. ... 28
Leach Co. ... 46
Lecourtenay Co. ... 50
Lee, Wm. S. ... 28
Leffel & Co., James ... 50
Lipe, Inc., W. C. ... 58
Locke Ins. Corp. ... 45

M

McClellan & Junkersfeld ... 28
Mansfield Sheet & Tin Plate Co. 38
Marble-Card Electric Co. ... 60
Maring Wire Co. ... 41
Maris Bros. ... 54
Mason & Parker Mfg. Co. ... 31
Massachusetts Mach. Shop, Inc. 60
Master Electric Co. ... 60
Master Rule Mfg. Co. ... 46
Mead, Daniel W. ... 29
Mead-Morrison Mfg. Co. ... 19
Metropolitan Device Corp. ... 2
Miller-Owen Elec. Corp. ... 35
Milliken Bros. Mfg. Co. ... 45
Moloney Electric Co. ... F. C.
Moore & MacDonald ... 37
Morganite Brush Co. ... 59
Morse Chain Co. ... 60
Motor Repair & Mfg. Co. ... 36
Mullergren, A. L. ... 29
Munsell Co., Eugene ... 41

N

Nashville Ind. Corp. ... 36, 37
National Power Machy. Co. ... 34
National Vulc. Fibre Co. ... 40
Neall, N. J. ... 29
Nussbaum & Co., V. M. ... 37

O

Ohio Brass Co. ... 46
Okonite Co., The ... 45
Ophuls & Hill, Inc. ... 29

P

Packard Electric Co. ... 42
Paragon Elec. Co. ... 42
Partridge Lumber Co., T. M. ... 44
Phoenix Utility Co. ... 37
Pittsburgh Elec. Furnace Corp. 50
Pittsburgh Transformer Co. ... 42
Positions Vacant ... 30
Positions Wanted ... 30
Portland-Monson Slate Co. ... 39
Power Machinery Ex. ... 34
Power Specialty Co. ... 50
Public Service Prod. Co. ... 29

R

Railway & Industrial Eng. Co. . 45
Randle Machy. Co. ... 34
Redmanol Co. ... 39
Reed Air Filter Co. ... 23
Reed, Edgar W. ... 29
Reliance Elec. & Engr. Co. ... 58
Repairing ... 31
Reparit Mfg. Co. ... 40
Reynolds Elec. Co. ... 58
Ridgeway Dynamo & Eng. Co. . 54
Riley Stoker Corp. ... 50

Page

Riter-Conley Co. ... 45
Robinson & Co., Dwight P. ... 29
Roebling's Sons Co., John A. ... 38
Roller-Smith Co. ... 43
Ross Power Equipment Co. ... 35
Roswell, C. M. ... 36
Roth Bros. & Co. ... 60

S

Sachsenmaier Co., George ... 33
Safety Insulated Wire & Cable Co. ... 40
Samson Cordage Works ... 40
Sanderson & Porter ... 29
Sangamo Elec. Co. ... 18
Sargent & Lundy ... 29
Scheinert Co., A. ... 35
Schweitzer & Conrad, Inc. ... 5
Scofield Engr. Co. ... 29
Searchlight Section ... 30-37
Sessions Engrg. Co. ... 29
Sherman Mfg. Co., H. B. ... 41
Simplex Wire & Cable Co. ... 4
Smith & Serrell ... 60
Smith Co., S. Morgan ... 50
Speer Carbon Co. ... 55
Spooner & Merrill ... 29
Standard Underground Cable Co. 43
Star Electric Motor Co. ... 59
Stevens Co., C. H. ... 34
Stevens & Wood ... 29
Steward Mfg. Co., D. M. ... 38
Sturtevant Co., B. F. ... 60
Sundh Electric Co. ... 43

T

Taylor Instrument Co. ... 54
Thebo, Starr & Anderton ... 29
Thomas & Sons Co., R. ... 43
Thomas, Percy H. ... 29
Tomatsuri, Masi ... 29
Triumph Elec. Co. ... 59
Trumbull Elec. Mfg. Co. ... 43

U

Union Elec. Lt. & Power Co. ... 36
Union Elec. Mfg. Co. ... 60
United Power & Light Co. ... 37
Universal Crane Co. ... 45

V

Valentine-Clark Co. ... 42

W

Ward Leonard Elec. Co. ... 60
Westbrook, John D. ... 36
Westinghouse Elec. & Mfg. Co., 12, 13, 14, 15
White Engrg. Corp., J. G. ... 29
Wireless Spec. Apparatus Co. ... 43
Wood & Weber ... 29
Woodward Governor Co. ... 54
Worcester Bleach & Dye Works Co. ... 40
Wyckoff Pile & Creosoting Co. . 43

Z

Zelnicker in St. Louis ... 37
Zernickow, O. ... 60
Zobell Elec. Motors Co. ... 58

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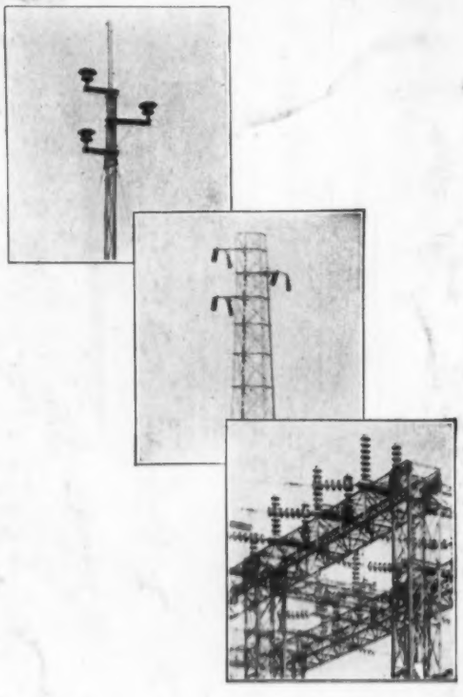

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